

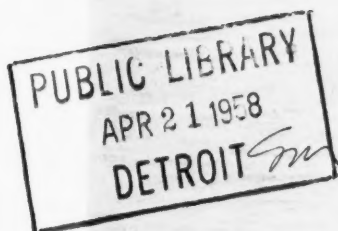
TECHNOLOGY DEPT.

RIL, 1958

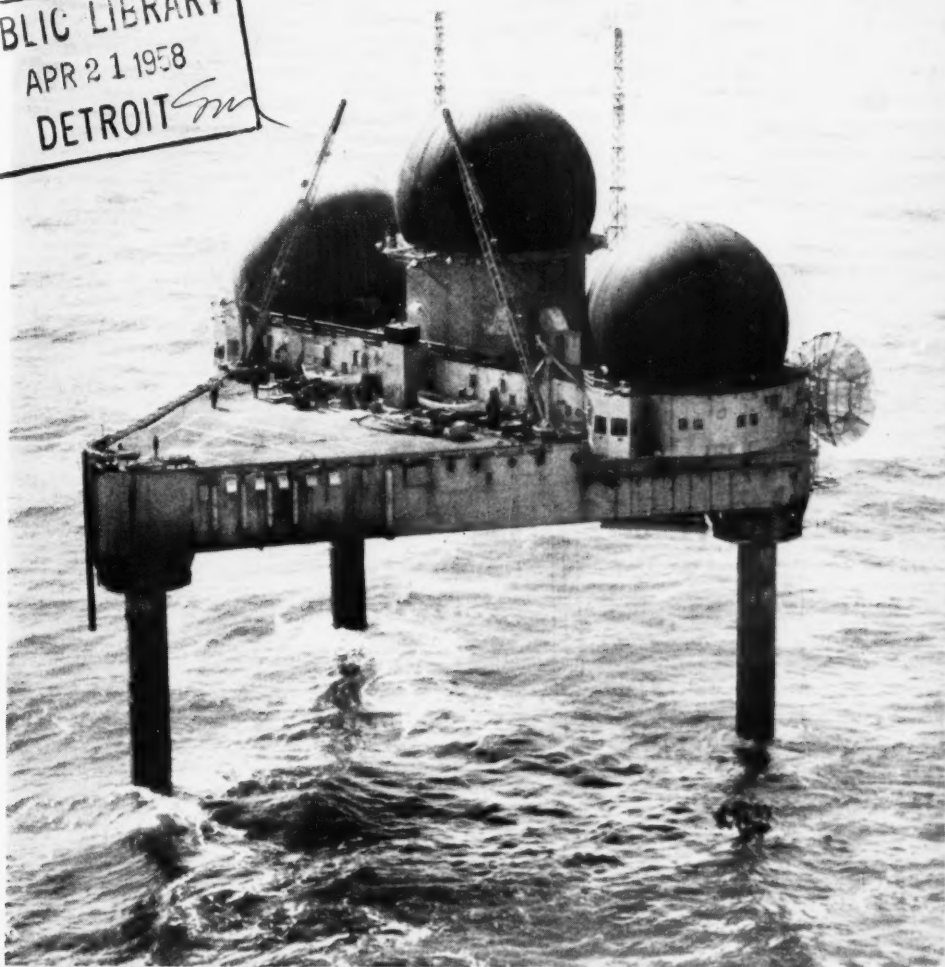
ments, page 4

RUBBER WORLD

SERVING THE RUBBER INDUSTRY SINCE 1889



Air Force Texas Tower
Off Cape Cod Supports
Three Rubberized Fabric
Radomes by Firestone



BILL BROTHERS
PUBLICATION

LOW-TEMPERATURE PROPERTIES
OF 80% CIS-POLYBUTADIENE

By Rallsback and Morris, page 75



FOR SURGERY...more dependable rubber sundries with Du Pont ANTOX®

Rubber products play an important part in modern-day surgery. In the operating room, there can be no allowance for their failure; they must be dependable without question.

That's why so many rubber products for home, hospital and surgical use are protected with Du Pont ANTOX. Unlike ordinary antioxidants, ANTOX does more than just protect against natural and heat aging. Transparent items like nipples and catheter tubing are protected from frosting and fogging, whether caused by oxidation, light or acceleration. Colored stocks containing ANTOX withstand repeated sterilizations without fading.

ANTOX has proven effective in other fields, as well. For example, ANTOX prevents uncured adhesives and pressure sensitive tapes from drying out—helps them keep their tackiness longer. HYPALON® stocks containing ANTOX display high resistance to elevated temperatures.

Du Pont ANTOX, a liquid antioxidant, can be mixed into dry elastomers or dispersed for use in latex. It discolors only slightly. Because ANTOX activates thiurams and thiazoles, a smaller amount of accelerator is required.

Contact our nearest district office for more information about Du Pont ANTOX.

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Department, Wilmington 98, Delaware

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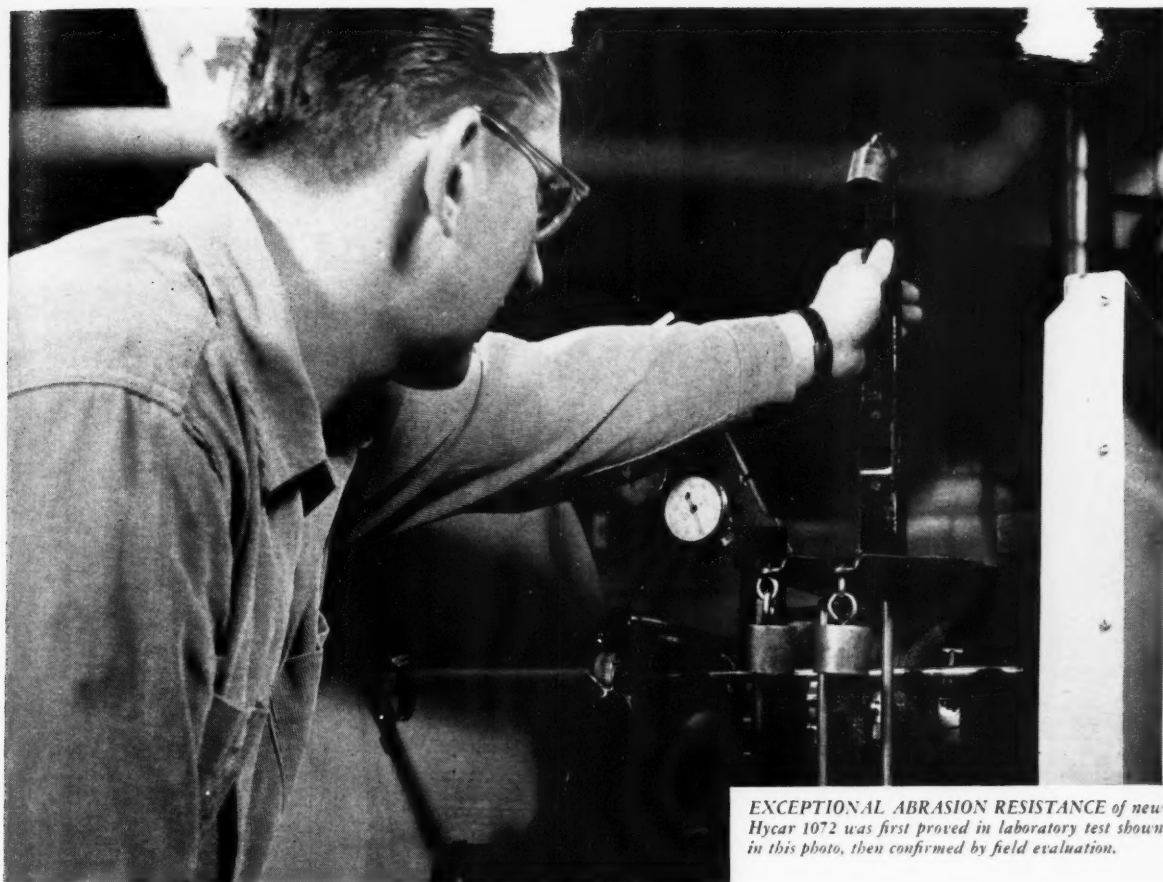


BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

RUBBER WORLD, April, 1958, Vol. 138, No. 1. Published monthly by BILL BROTHERS PUBLISHING CORP., Office of Publication, 3rd & Hunting Park Ave., Philadelphia 40, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U. S. A. Entered as Second Class matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription United States \$5.00 per year; Canada \$6.00; All other countries \$7.00. Single copies 50c. Address Mail to N. Y. Office. Copyright April, 1958, by Bill Brothers Publishing Corp.

News about

B.F. Goodrich Chemical *raw materials*



EXCEPTIONAL ABRASION RESISTANCE of new Hycar 1072 was first proved in laboratory test shown in this photo, then confirmed by field evaluation.

Gives outstanding abrasion resistance

HYCAR 1072

FINISHED parts made with Hycar 1072 have from four to ten times the abrasion resistance of parts made with typical nitrile rubbers. Gum tensile strength is unusually high. Ozone resistance is exceptional.

Hycar 1072 retains its good physical properties at elevated temperatures. High hardness and excellent physical properties

can be obtained without the excessive loading that might otherwise interfere with good processing.

For further information on properties of Hycar 1072, write Dept. KB-4, B.F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Hycar
Reg. U.S. Pat. Off.
American Rubber

B. F. Goodrich Chemical Company
a division of The B. F. Goodrich Company



GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

April, 1958

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RUBBER WORLD

ARTICLE HIGHLIGHTS

POLYBUTADIENE BEST FOR ARCTIC SERVICE

Polybutadiene of 80% *cis* configuration has been shown to be better than natural or any other synthetic rubber for low-temperature service.

75

CONTINUOUS EXTRUSION CURING DEVELOPED

A novel method of continuously curing extrusions of neoprene or other rubbers, employing a liquid curing medium of metal or oil, has been developed.

81

MORE ON CARBON BLACK MOISTURE ADSORPTION

The article on moisture adsorption of carbon black is concluded in this issue, with information on heat-treated channel blacks, effect of ash content of furnace blacks, adsorption in rubber-black mixes.

85

THE FOREIGN TECHNICAL INFORMATION PROBLEM

Present-day conditions may require a central agency in government to act as a clearing house for foreign technical information, if we are to get as quickly as possible translations of what we need.

73

HIGH-TEMPERATURE COMPOUNDS, URETHANES, LATICES

The advance program for the meeting of the Rubber Division, ACS, in May indicates new information on high-temperature compounds, urethanes, latices, vulcanization, and reinforcement.

91

STATISTICAL QUALITY CONTROL; THEORY AND PRACTICE

An introduction to the theory of statistical quality control and some details of its application are reported.

105



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The opinions expressed by our contributors do not necessarily reflect those of our editors

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Naugatuck PARACRIL OZO

THE NEW OIL- AND OZONE-
RESISTANT NITRILE RUBBER



Naugatuck's challenger for leadership in the field of ozone-resistant, oil-resistant rubber

Compared to the present leading competitive general-purpose oil-resistant, ozone-resistant rubber, Paracril® OZO vulcanizates show *marked superiority* in resistance to oil, fuel and weathering (ozone) and in color retention, abrasion resistance and low moisture absorption. In tensile strength, flame resistance and cost of complete compound, both are essentially the same.

Thus Paracril OZO provides a unique combination of properties far in excess of ordinary nitrile rubber!

But Paracril OZO is no ordinary nitrile rubber! It is a modified Paracril which incorporates the compounding discoveries of Naugatuck research chemists to which reference has been made in recent Paracril advertisements. The chief modifier is one of Naugatuck's Marvinol® vinyl resins, and

the product includes excellent stabilizers for both vinyl and rubber.

Paracril OZO is supplied in the form of small, light-colored flakes, permitting easy handling and considerable flexibility in processing methods.

A most important feature of Paracril OZO is that the vinyl resin in it is completely fluxed during its manufacture. This not only eliminates a difficult compounding procedure on the part of the user but also assures full development of the added properties imparted by the vinyl modifier.

Its unique properties particularly recommend Paracril OZO for wire jackets, shoe soles, coated fabrics, automotive parts, hose and belting jackets. Write for Bulletin No. 219 which contains compounding suggestions and interesting test data on Paracril OZO vulcanizates.



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Division of United States Rubber Company

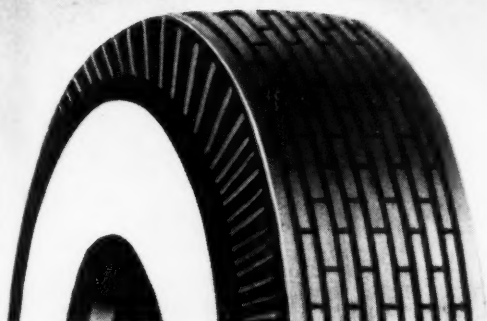
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A NEW LOW-COST, NONSTAINING ANTIOXIDANT

Why pay up to three times as much for a phenolic-type nonstaining antioxidant when NAUGAWHITE provides all the protection you need in your manufactured rubber products?

NAUGAWHITE is a liquid alkylated phenol which protects natural rubber, SBR and nitrile rubber against light, heat and oxygen degradation without discoloring the rubber or staining other materials by contact migration. It is especially useful in white sidewall tire

carcass compounds, white sidewalls, light-colored footwear, molded sundries, general latex products, foam sponge and light-colored products in general. In rug backings and foam sponge it imparts excellent resistance to the combustion products (nitrogen dioxide) from natural gas. NAUGAWHITE is easily emulsifiable for use in latex.

The handy request form will bring you more details.

NAUGATUCK CHEMICAL

420W Elm Street, Naugatuck, Conn.

- ☐ Please send data on Naugawhite.
☐ Have your representative call.
☐ Add my name to your mailing list to receive rubber chemical technical literature.

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Naugatuck Chemical

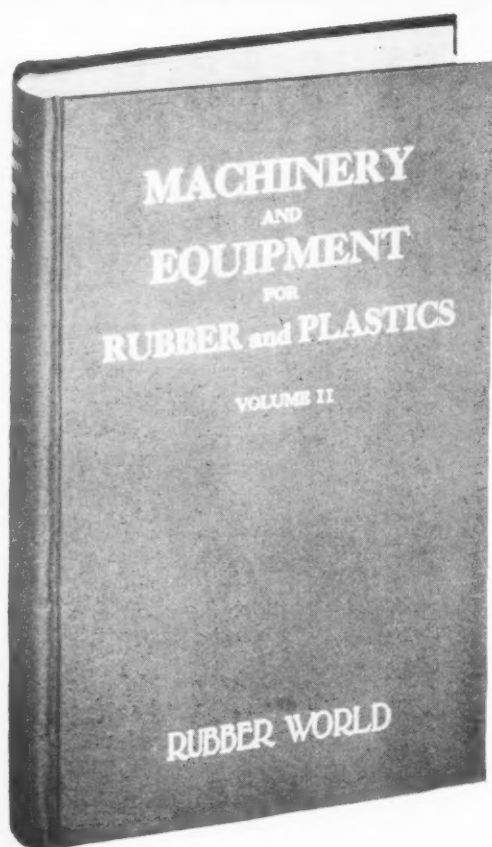
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START

5 grams of Protox-169 zinc oxide were added to 300 cc of distilled water.



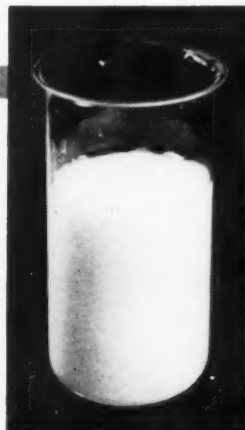
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The floating Protox mass starts swirling; dispersion begins.



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Turbulent diffusion is evident throughout the water.



15 MINUTES

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HOW PROTOX ZINC OXIDES CUT YOUR COSTS compared with conventional zinc oxides

- 1. Shorten grinding time**
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*U. S. Patents 2,303,329 and 2,303,330

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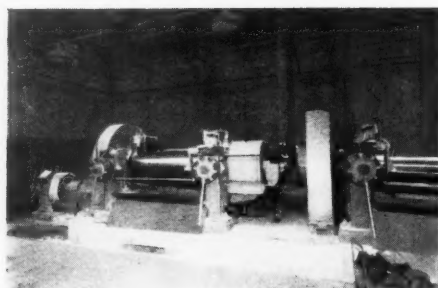
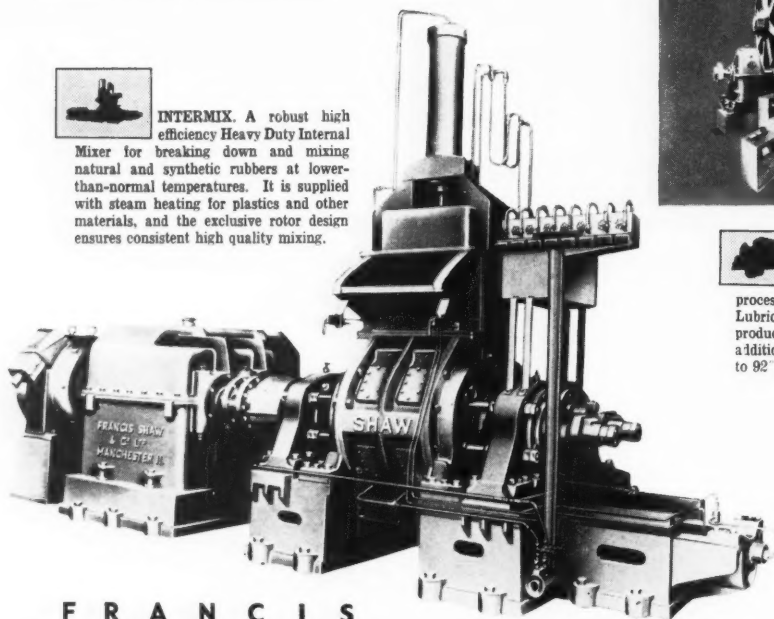
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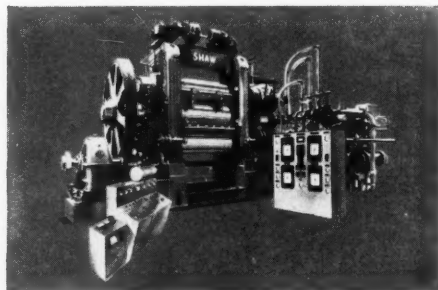


INTERMIX. A robust high efficiency Heavy Duty Internal Mixer for breaking down and mixing natural and synthetic rubbers at lower-than-normal temperatures. It is supplied with steam heating for plastics and other materials, and the exclusive rotor design ensures consistent high quality mixing.



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For the efficient mixing and warming of all thermoplastic-thermosetting materials Shaw produce a range of mills from 13" x 16" up to 84" x 26". Supplied in batteries or with individual drives, these machines are capable of high sustained output. Single or double geared models available. The machine shown is fitted with Lunn Safety Gear.



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P1156

Adamson United Co., 730 Carroll Street, Akron, have the manufacturing and selling rights of the Shaw Intermix and hold non-exclusive selling rights in Central America, South America, and Mexico.



Photo courtesy Cameron Iron Works, Inc., Houston, Texas, and Linear, Inc., Philadelphia, Pa.—Manufacturers of Precision Molded Seals

How to make 4 lbs. of rubber pack a 1000-ton load

To **batter a billet** into rough shape, prior to machining, is no chore for the hydraulic forging press shown above. A press of a button and it works down the hot steel with a thousand tons of pressure every several seconds.

But it **was a chore** to find an adequate seal for the big press ram. Its designers looked long and hard before they found a split ring packing that would not leak under the high pressure and fast traverse.

Twin secret of the success of the fabric-reinforced, precision-molded, rubber rings now used are their unique design—and **CHEMIGUM**. A series of internal, V-shaped dams and external abutments seal off any labyrinth leakage, while the **CHEMIGUM** assures a lastingly tight fit.

The reasons why the ring manufacturer uses **CHEMIGUM** for this and other precision seals are its excellent resistance to oil, heat and abrasion and its unusual ease of processing. How can this outstanding combination of properties benefit your product? For details, write to Goodyear, Chemical Division, Dept. P-9418, Akron 16, Ohio.



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CHEMIGUM • PLIOFLEX • PLIOLITE • PLIOVIC • WING-CHEMICALS

High Polymer Resins, Rubbers, Latexes and Related Chemicals for the Process Industries



Photo courtesy Exide Industrial Division, Electric Storage Battery Co., Philadelphia, Pa.

Want a battery of compliments?

If you're looking for a product that will win compliments everywhere, why not take a lesson from the manufacturer of the big batteries shown above. For he has learned through experience, that some jobs are just made to order for PLIOFLEX rubber.

His particular problem lay in finding the right material for the battery cases. Conventional container materials just didn't have the strength or resilience to withstand the shock, pressure and abuse of rugged Diesel locomotive service. His answer was to pioneer the use of fully molded, hard rubber cases and covers.

At first, natural rubber was used. But then his case supplier suggested changing to PLIOFLEX. The reasons? PLIOFLEX is considerably more uniform, accepts a wider variety of fillers for easier compounding, processes more readily and cures faster. The end result: A better battery case at lower cost.

How can PLIOFLEX improve your product? Why not find out by writing, today, for full details and the finest in technical assistance. Address:

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Dept. P-9418, Akron 16, Ohio



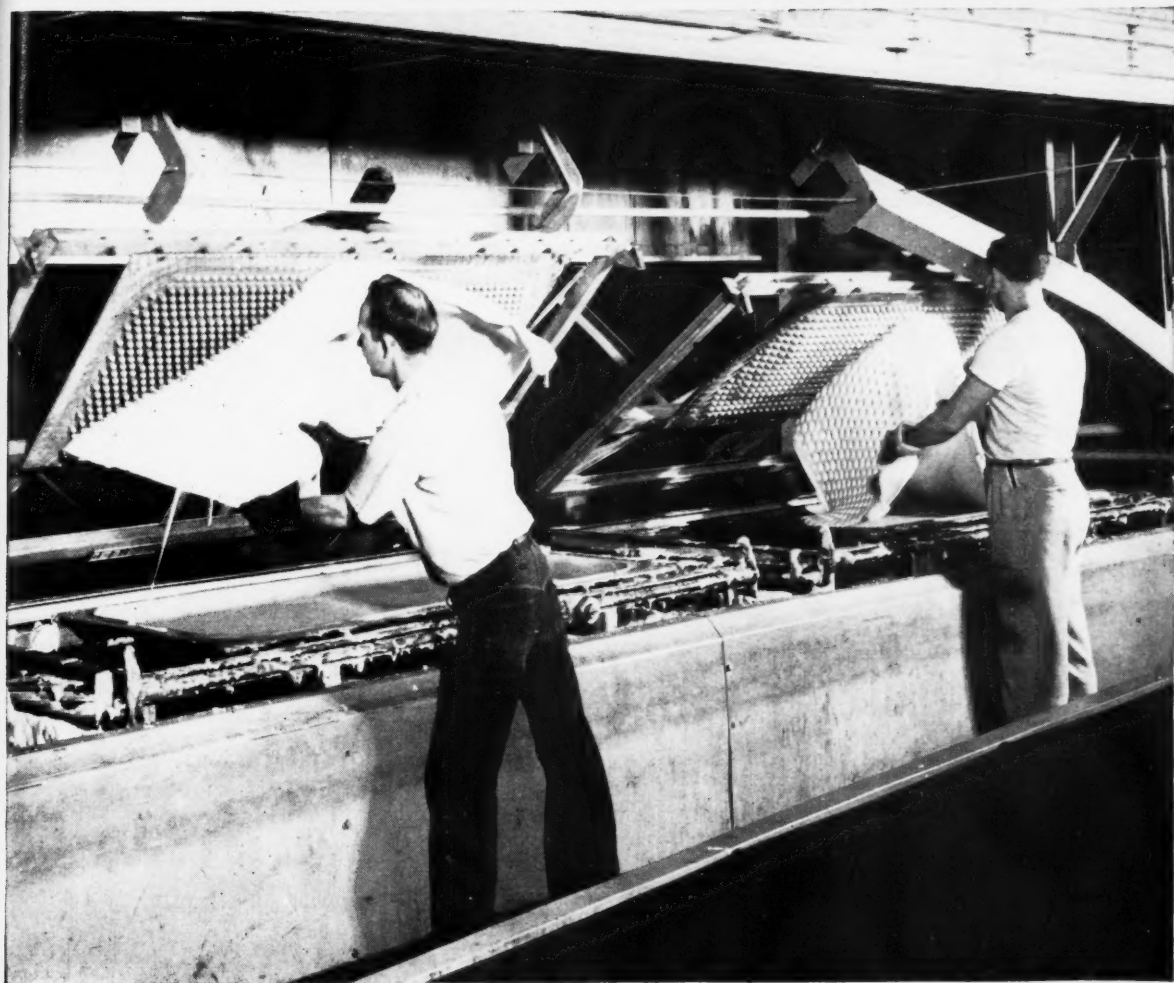
GOOD YEAR

CHEMICAL DIVISION

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIOVIC • WING-CHEMICALS

Chemigum, Plioflex, Pliolite, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio





What's first and foremost for foam?

First and foremost choice of a number of manufacturers of foamed rubber products is one of two Goodyear latices—PLIOLITE LATEX 2104 or PLIOLITE LATEX 2105.

PLIOLITE LATEX 2104 is a "cold" polybutadiene latex which exhibits virtually no odor. This feature plus its high solids content and excellent mechanical stability make PLIOLITE LATEX 2104 extremely well-suited to the production of pillows, mattresses and other types of cushioning.

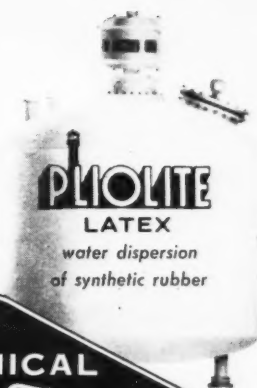
PLIOLITE LATEX 2105 is a "cold," high solids, butadiene/styrene latex. It, too, exhibits excellent mechanical stability with light color, high physical properties and low temperature flexibility—for advantageous use in foamed goods where very slight odor is permissible.

In addition to these latices, there are a number of other rubber and resin latices in the PLIOLITE family. Each can be used alone or in combination with the others to obtain specific properties in foam or any of the many applications for latex.

Details plus the latest *Tech Book Bulletins* on PLIOLITE LATEX are yours by writing to:

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NOT A CHANCE FOR CRUMB TO CAKE

in

SARGENT'S

new three-decker

RUBBER DRYER

Rubber crumb moving through a dryer has an annoying tendency to cake. It was always a bogie until Sargent did something about it. They designed a simple and highly effective intermeshing type of stock breaker that provides a positive means for breaking the crumb into fine particles as it transfers from one conveyor to another, or from conveyor to delivery.

THERE IS NO CHANCE FOR THE DRYING CRUMB TO CAKE OR BUILD UP.

This is only one of the many exclusive Sargent advanced engineering features of their new, 11 section, 3 conveyor dryer designed for synthetic rubber. Separate sections, for example, are provided at entering and delivery

ends (away from the heat of the drying chambers) to house all driving mechanisms, cleaning mechanism and Alemite System. The entire non-fan side of the dryer is a series of full-height hinged panels for easy access to any part of the dryer interior. The same hinged panels are placed wherever possible on the fan side also, so there is not one hidden or hard-to-reach spot in the dryer's entire 62 feet length. Guaranteed minimum production is 5,000 pounds per hour at entering moisture content of 35%. Leaving dryer, moisture content of the rubber crumb is a constant 0.5%.

The dryer has the usual Sargent rugged, sturdy construction and as with all Sargent dryers, installation at

customer's plant is effected in record-quick time. It is completely automatic from feed to delivery, and in operation requires a minimum of operator attention.

A Sargent-designed continuous automatic feed delivers a steady, even bed of rubber crumb to the stainless steel conveyor. In addition to the traveling stock guides along the steel conveyor flights, stationary stock guides are provided to prevent any material being blown on to the driving chains. Safety shear pins are provided at each drive to prevent damage from accidental jamming of the conveyor. Every known safety device for protection of personnel, machine, and stock, is employed in this dryer.

A Sargent rubber dryer can help YOU to better production at lowered operating costs. Just write your nearest representative, or write us direct, for information.

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BALANCE?
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TRADE-MARK

FLEXOL plasticizer DOP—CARBIDE's brand of di(2-ethylhexyl phthalate)—is the *standard*. It's the most widely used plasticizer in the vinyl plastic industry today. Why? Because FLEXOL DOP has balance.

DOP represents an outstanding balance of compatibility, low volatility, low temperature flexibility, and remarkable heat and light stability. The fine balance of these and other performance properties plus DOP's economy make it the all-around plasticizer for

- calendered vinyls
- cast vinyls
- molded vinyls
- extruded vinyls
- plastisol-fabricated vinyls

The rigid specifications of FLEXOL DOP assure you of superior quality with every shipment.

And, don't forget, if your product requires unusual performance properties, CARBIDE makes a FLEXOL plasticizer to do the job. For instance:

- FLEXOL TOF, *tri(2-ethylhexyl) phosphate*, for low temperature flexibility
- FLEXOL 10-10, *didecyl phthalate*, for permanence
- FLEXOL 426, *butyl-octyl phthalate*, for performance *plus* economy
- FLEXOL R-2H, *a polyester*, for low volatility and extraction resistance
- FLEXOL 380, *a monomeric phthalate*, for lacquer mar resistance

CARBIDE's wide selection of plasticizers also means you can take advantage of the savings due to combination tank car, tank truck, and car loads. CARBIDE's basic raw materials position and many shipping points guarantees you quick delivery of FLEXOL plasticizers and the quality and quantity you need.

For more information on DOP and other FLEXOL plasticizers—write Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, N. Y. In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Toronto.

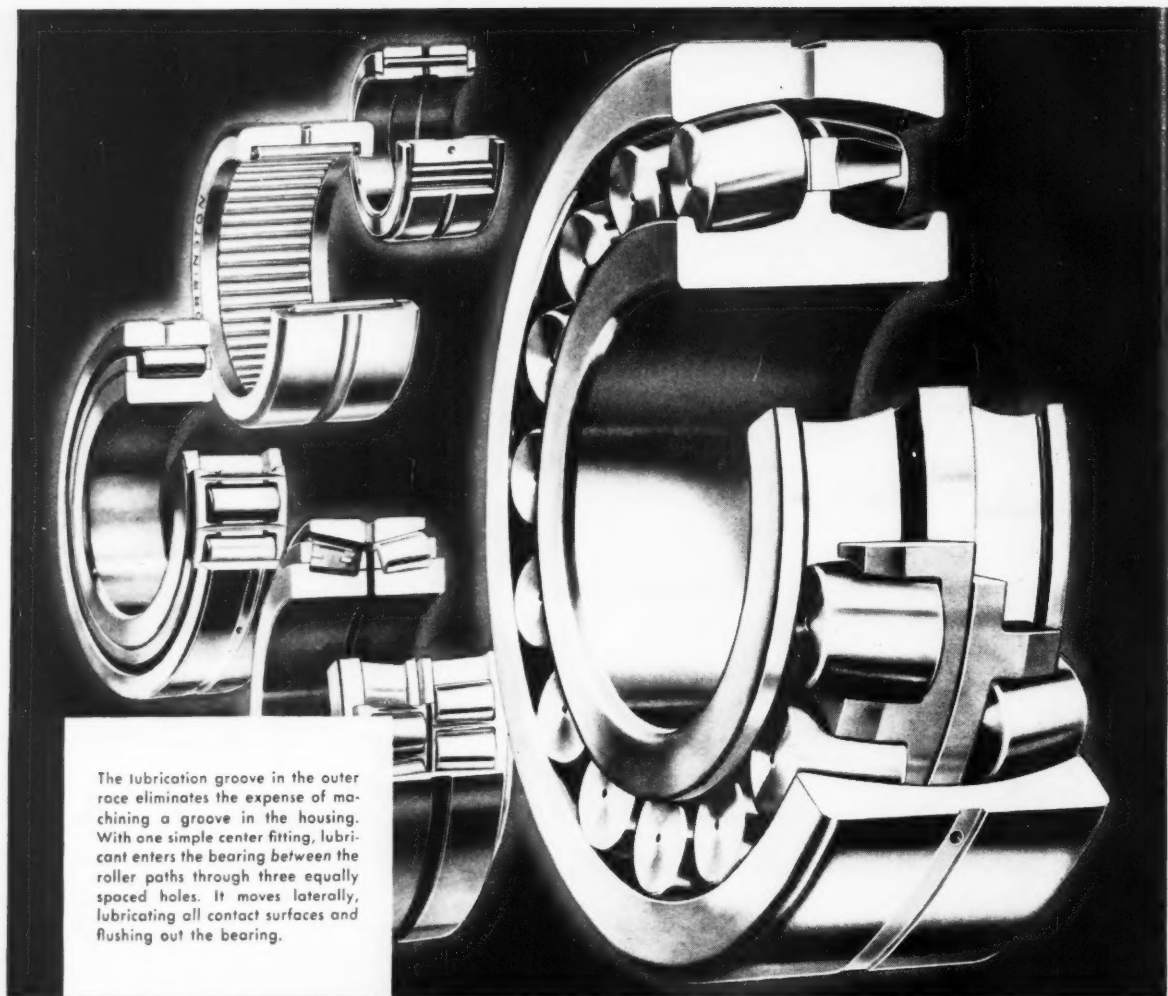
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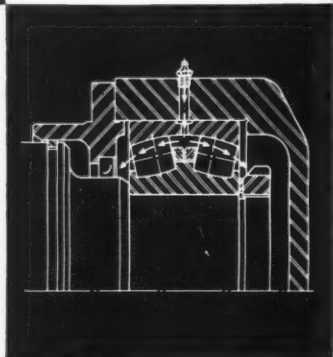
CHEMICALS



Union Carbide Chemicals Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y.



The lubrication groove in the outer race eliminates the expense of machining a groove in the housing. With one simple center fitting, lubricant enters the bearing between the roller paths through three equally spaced holes. It moves laterally, lubricating all contact surfaces and flushing out the bearing.



A time-proved lubricating method now available on Torrington Spherical Roller Bearings

The circumferential groove in the outer race has met the test of experience in many Torrington Bearings, including Heavy Duty Needle Bearings, Aircraft Type Needle Bearings, Tapered and Radial Roller Bearings. Now the circumferential lubrication groove is available in Torrington Spherical Roller Bearings.

This design feature makes it possible to introduce lubricant *between* the roller paths without the expense of machining a groove in the housing. This groove is proportioned to provide generous lubricant flow capacity. Lubricant moves through the roller paths, flushing used lubricant and contaminants away from bearing contact surfaces.

Torrington Spherical Roller Bearings in many sizes may be ordered with this groove as desired at no additional cost. For further information, see your Torrington representative or write: **The Torrington Company, South Bend 21, Ind.—and Torrington, Conn.**

TORRINGTON BEARINGS

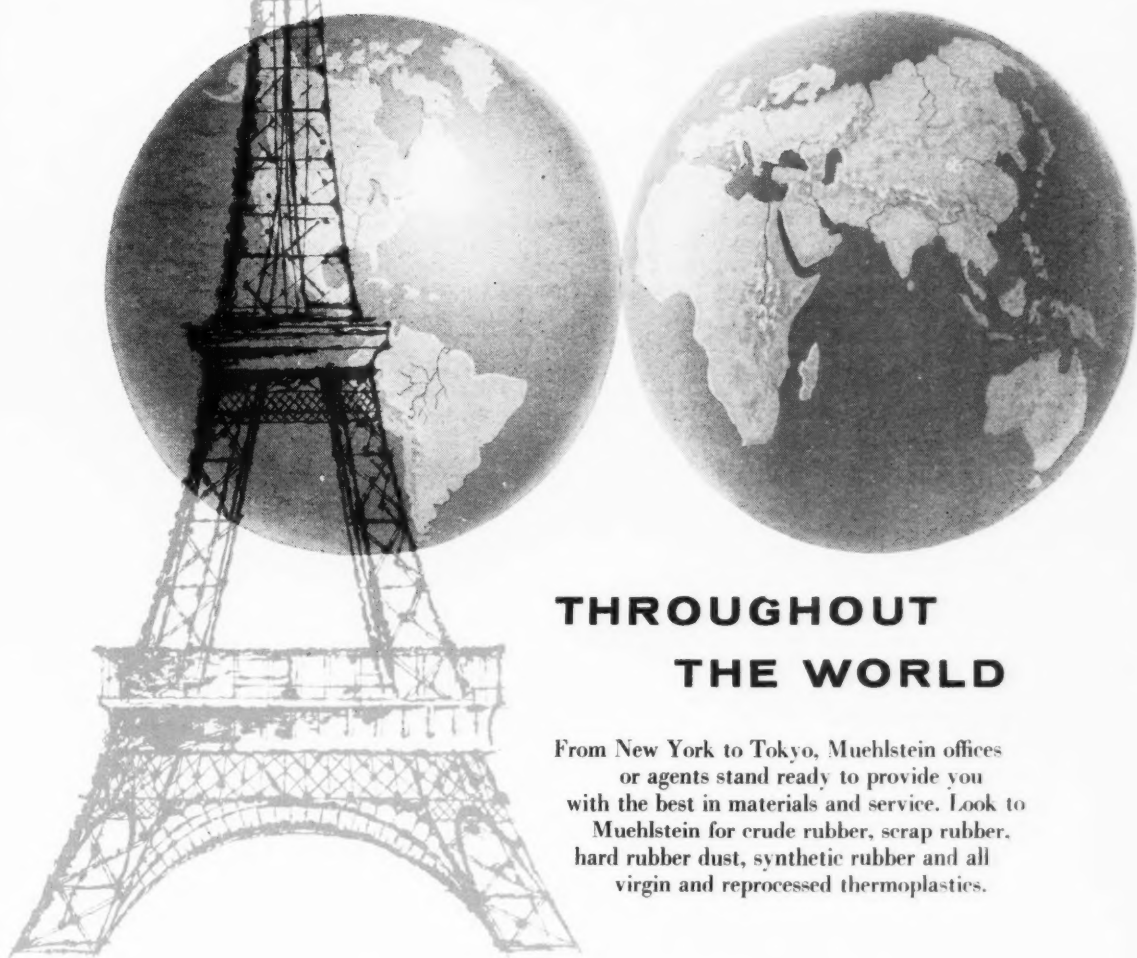
District Offices and Distributors in Principal Cities of United States and Canada

SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • NEEDLE • BALL • NEEDLE ROLLERS • THRUST

*Wherever rubber
or plastics are used . . .
there's a*

MUEHLSTEIN

*office or agent
to serve you*



THROUGHOUT THE WORLD

From New York to Tokyo, Muehlstein offices or agents stand ready to provide you with the best in materials and service. Look to Muehlstein for crude rubber, scrap rubber, hard rubber dust, synthetic rubber and all virgin and reprocessed thermoplastics.

H. MUEHLSTEIN & CO.

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REGIONAL OFFICES: Akron • Chicago • Boston • Los Angeles • London • Toronto

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DON'T BE AN Old Fashioned COMPOUNDER

... Get Hep to

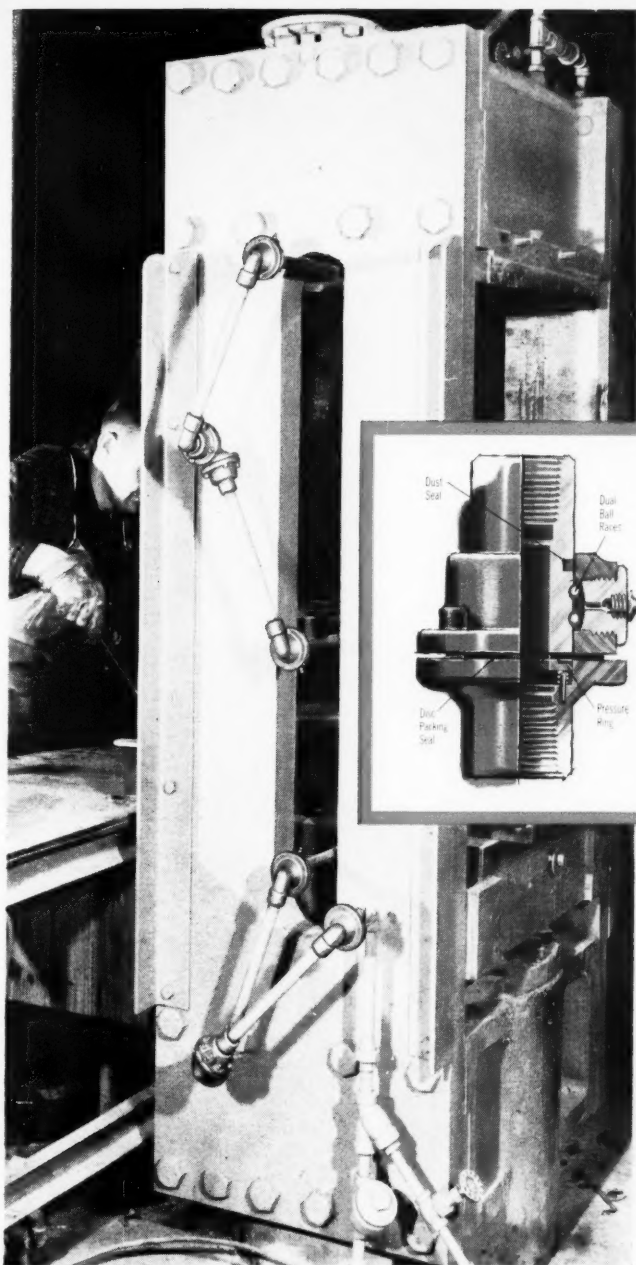
STABILITE* ANTIOXIDANT

** Manufactured by Chemico, Inc.
Distributed by The C. P. Hall Co.*

AKRON, OHIO
LOS ANGELES, CALIF.
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NEWARK, N. J.

The C. P. Hall Co.
CHEMICAL MANUFACTURERS





Typical of its diverse applications, the Discpak Swivel Joints, installed on the steam lines of the above platen press, provide predetermined travel arc, allow for packing replacement without removal from the line.

Chiksan Discpak Swivel Joints eliminate hose replacement costs, provide controlled line flexibility and end hose rupture hazards. A low cost seal is easily inserted *without* removing joint from the line. Savings in downtime and replacement costs quickly repay cost of installation. Don't delay, send for literature and name of your nearest Chiksan field engineer today.

NOW- CHIKSAN DISCPAK

SWIVEL JOINTS

INSURE SAFE,
LASTING
FLEXIBILITY
FOR HOT GAS
AND STEAM
SERVICE LINES...

*Replace packing with joint
in the line—*

*Keeps line flexing in
predetermined arc—*

*Free swiveling with extremely
low torque—*

*Ideally suited on lines handling
alternate steam and
cold water flow—*

*Unlimited service life with
minimum maintenance—*

Send for this informative
Bulletin DP100. Contains
detailed cutaway and dimensions
of the complete Discpak line. →

CHIKSAN DISCPAK
SWIVEL JOINTS

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION



CHIKSAN



#58-32

CHIKSAN COMPANY—BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada, Ltd.

April, 1958

19

Where

UNIFORMITY

PRECISION

DEPENDABILITY

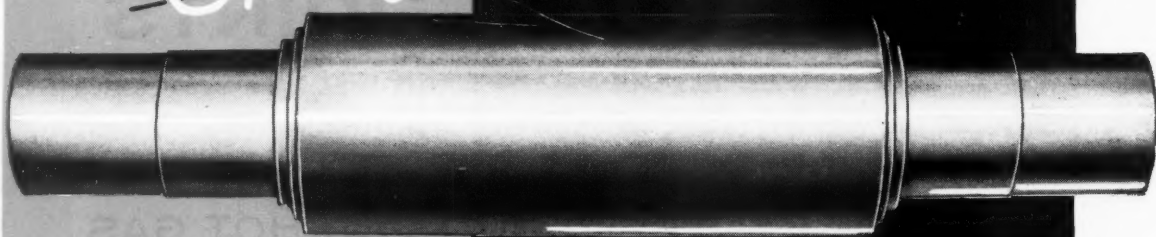
are factors . . .

Specify →

UNITED[®]

DRILLED-TYPE

ROLLS



for the precision
calendering of

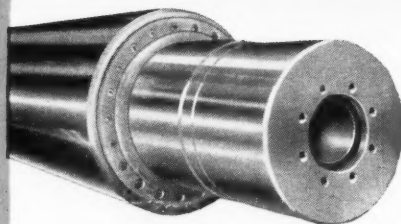
PLASTICS

RUBBER

TILE

LINOLEUM

or any materials requiring
close heat control



UNITED Precision Ground, DRILLED-TYPE ROLLS, the result of careful metallurgical control over raw materials, and of strict quality control in every phase of manufacture . . .

MAINTAIN A UNIFORM ROLL SURFACE TEMPERATURE throughout, with minimum deviation at any point.

ASSURE FULL RANGE HEATING and cooling over wide temperature ranges.

PROVIDE ACCURATE, QUICKLY RESPONSIVE TEMPERATURE CONTROL.

UTILIZE FULL ROLL FACE with new, ring closure type designs.

PERMIT ADJUSTMENT OF RING CLOSURE GASKET AND BOLTS, WITH ROLL IN PLACE in calender or mill, thus eliminating production downtime due to roll removal.

MAINTAIN CORRECT DEPTH OF CHILL for iron or alloy iron rolls.

ARE ENGINEERED AND DESIGNED FOR MAXIMUM HEAT TRANSFER RATE with accurately drilled, fluid passages.



Our more than 50 years experience in the design and manufacture of rolls can be helpful in solving your processing problems. Your inquiry is solicited.

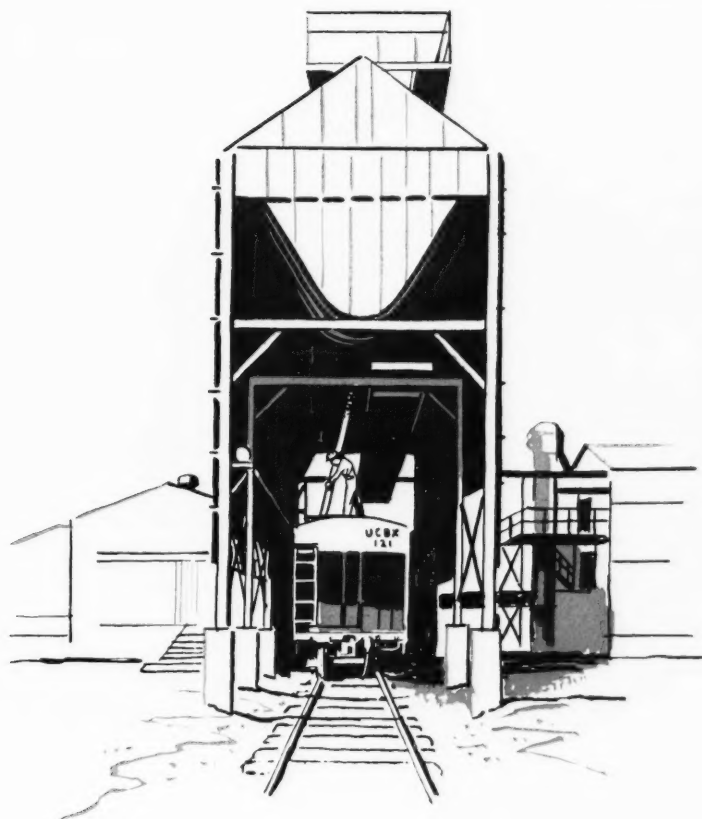
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ENGINEERING AND FOUNDRY COMPANY
PITTSBURGH, PENNSYLVANIA

Plants at • Pittsburgh • Vandergrift • Youngstown
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Designers and Builders of Ferrous and Nonferrous Rolling Mills,
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other heavy machinery. Manufacturers of Iron, Nodular Iron and
Steel Castings and Weldments.



*More than
thirty-three years
devoted to the making
of superior carbon blacks
for all rubber needs*

UNITED CARBON COMPANY, INC.

UNITED CARBON BLACKS

For leadership in carbon black, compounders look to high abrasion furnace HAF black — **obviously Dixie 60**, the black with an unexcelled record for uniformity and high standard of quality.

DIXIE 60 satisfies from the very start with fast mixing, good dispersion, dependable extrusion, tight cure, outstanding reinforcement, high resistance to chunking, cracking, and abrasion, and enviable road-wear performance.

DIXIE 60 has all it takes to meet keen competition and the exacting demands of the rubber industry.

UNITED BLACKS have forged a name for themselves over the world. Standardize on **UNITED BLACKS** to achieve extra quality products.

UNITED CARBON COMPANY, INC.

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MICROFLAKE

UNSURPASSED

Protection Against Ozone & Sunlight

In natural, GR-S, Neoprene and Butyl rubbers MICROFLAKE offers maximum protection against the action of atmospheric deterioration. Blooming to the surface, it forms a continuous protective film which does not change under varying climatic conditions, due to the migration rate being fairly constant at high or low temperatures.

Low melting point of MICROFLAKE, plus its very small thin flake size assures rapid and complete dispersion during mixing. It has no effect on the rate of cure.

MICROFLAKE is recommended for passenger car, truck, and tractor tires, channel rubbers, weatherstrips, boots, gas tank filler, neck grommets, insulated wire and cable, hose, belting, footwear, clothing, druggist sundries, and sponge rubber products such as door and trunk sealers.

A test sample incorporated in any of your compounds will convince you of MICROFLAKE's outstanding protective qualities. Write us today. . . No Obligation, of course.

Also Mfrs. of **RUBBEROL** **SYNTHOL** and
GLYCERIZED LUBRICANT

ESTD 1884
QUALITY SINCE 1884

G E N S E K E B R O T H E R S

RUBBER MATERIALS DIVISION

West 48th Place and Whipple Street

Chicago 32, U.S.A.

GEN-TAC prevents

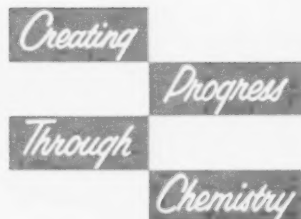


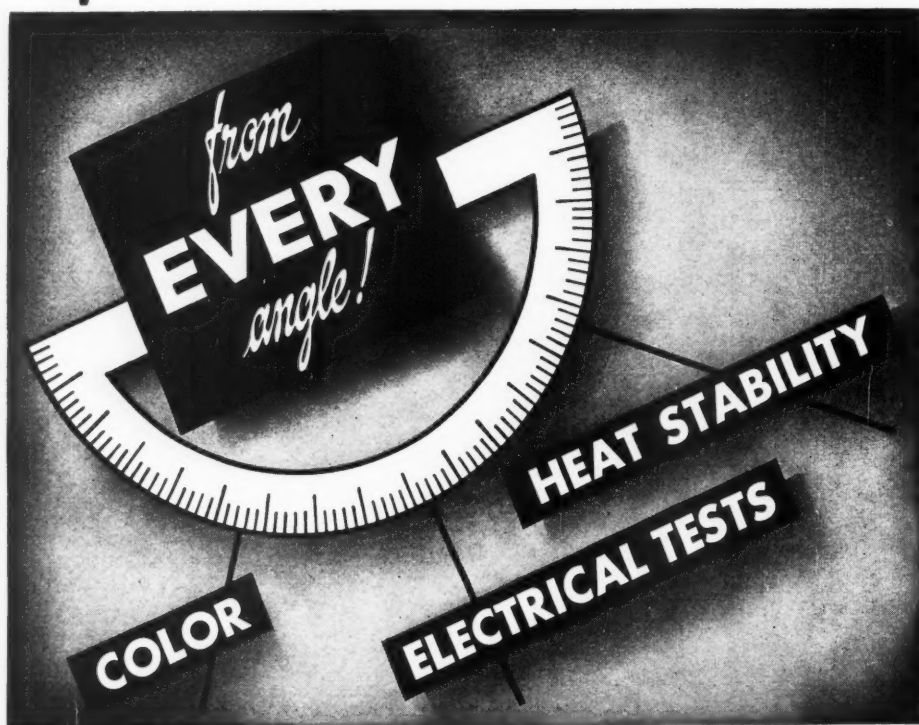
s "wicking" in chafer fabrics

In co-operation with General Tire's technical staff, tire fabric manufacturers have found the best solution to one of the tire-maker's most troublesome problems—air "wicking" through chafer fabric! Gen-Tac[®] is the answer . . . used on multifilament cord, its outstanding qualities assure positive protection against "wicking" and provide superior rubber-to-fabric adhesion.

A specially prepared Gen-Tac dip penetrates cords completely, binding each filament securely and permanently. Its exceptional adhesion unitizes the cords, preventing air passage through the chafer strip. Be sure your tire fabric, whether monofilament or multifilament, is treated with Gen-Tac, for best product performance.

THE GENERAL TIRE & RUBBER COMPANY
CHEMICAL DIVISION • **AKRON, OHIO**





PIGMENT NO. 33

for Compounding

VINYLS AND
SYNTHETIC RUBBER

Sample and technical data
sent promptly on request

SOUTHERN CLAYS, Inc.

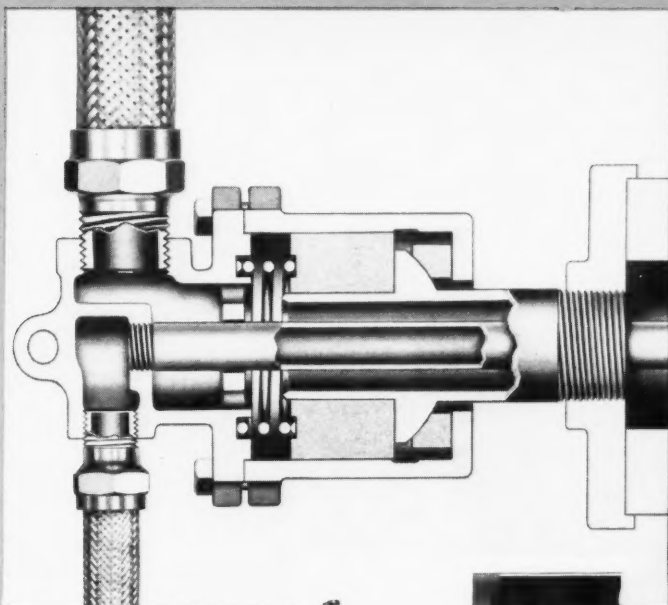
33 RECTOR STREET
NEW YORK 6, N. Y.

FIRST IN THE RUBBER AND PLASTICS INDUSTRY...

JOHNSON Rotary Pressure JOINTS

For water cooled or steam heated rolls...

For the job of getting water or steam—or both, intermittently—into mills and calenders, Johnson Joints out-number and out-perform anything of their kind. All of those you see here seal without packing, need no lubrication or adjustment, and are completely self-supporting. They take today's high speeds, pressures and temperatures right in stride—can be furnished for use with Dowtherm, Monsanto Aroclors and hot heat transfer oils up to 700°F., pressures to 250 psi. and higher.

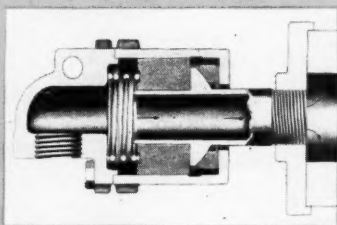


TYPE SB JOHNSON JOINT

Used with stationary steam or water distribution pipe on cored rolls. See typical installation with chilled water spray pipe. Joint has only four internal parts, which means fewer breeding places for trouble and permits ready servicing right in the field.

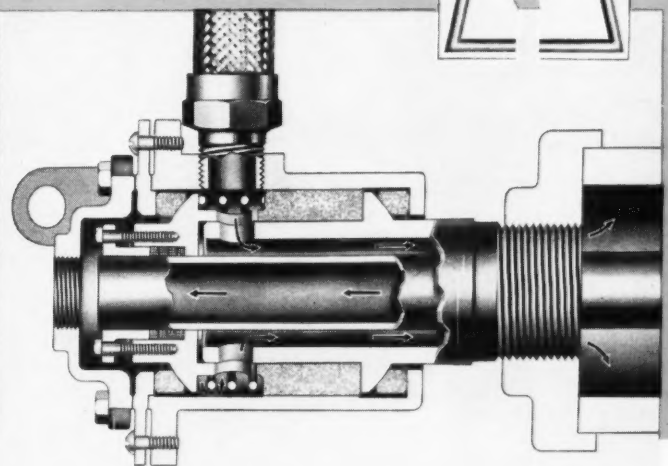
TYPE SN JOHNSON JOINT

Used for rotating internal pipe applications. See typical installation on drilled roll. Assembly plate between head and body of joint facilitates mounting and inspection. The seal between rotating and stationary surfaces is still accomplished without any packing.



For Calender trains, too...

Type SA Johnson Joints are ideal for through-flow service on cooling rolls. They are compact in size, need no external supports.



Write for full information.



THE JOHNSON CORPORATION

869 WOOD STREET • THREE RIVERS, MICHIGAN

Rotary Pressure Joints • Direct Operated Solenoid Valves



A FRESH TACK TO A TACKY PROBLEM—Cooper Tire & Rubber Company were anxious to develop an alternate liner fabric for the one they had been using. One possibility suggested was a new blend of cotton and rayon recently developed by Mount Vernon Mills. Cooper Company gladly agreed to give it a try. Results have been beyond anyone's expectations! Despite its slightly *lower* original cost, this new fabric has worked equally as well as any fabric previously used—and lasted much longer besides.

This is another example of how fabrics made by Mount Vernon Mills, Inc. and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

UNIFORMITY
Makes The
Big Difference
In Industrial
Fabrics



Mount Vernon Mills, Inc.

A LEADER IN INDUSTRIAL TEXTILES

TURNER HALSEY
COMPANY
Selling Agents

Main Office and Foreign Division: 40 Worth Street, New York, N. Y.
Branch Offices: Chicago • Atlanta • Baltimore • Boston • Los Angeles

**"cracked already
and it hasn't even
rolled yet!"**



Ozone damage to an unused tire can make
an Ambassador of Ill Will for your brand.

UOP 88 & 288 prevent ozone damage for the life of the tire

This man has just become somebody's ex-tire-customer. And no wonder. Ozone cracks are not only unsightly but they materially reduce the strength and durability of the tire.

Obviously, this tire manufacturer failed to give his product the kind of built-in *chemical* protection that UOP 88 and 288 insure. Pre-mold addition of UOP 88 and 288 mean absolute

protection against ozone damage and weather checking.

Are your tires getting this kind of protection? Better let us send you samples of UOP 88 and UOP 288 for testing in your own laboratories. Or, if you prefer, we'll be very glad to help you work out the correct antiozonant formulation for your product. Write our Products Department.

UOP 88[®] and 288
TRADEMARK
RUBBER ANTIOZONANTS



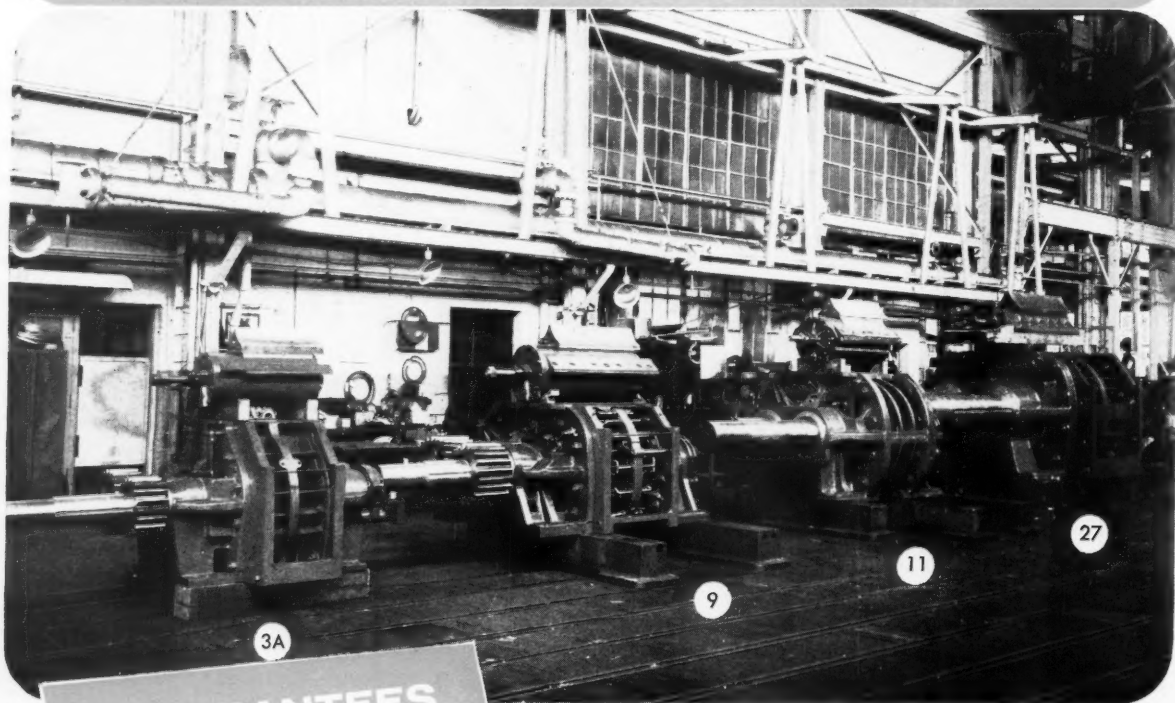
**UNIVERSAL OIL
PRODUCTS COMPANY**

30 ALGONQUIN ROAD
DES PLAINES, ILLINOIS, U. S. A.

SECO

REBUILT BANBURY MIXERS

ESTABLISHED 1868



GUARANTEES
NEW
EQUIPMENT
PERFORMANCE

INTERCHANGE PLAN:

For a minimum of down time, investigate our guaranteed interchange plan.

STOCK PARTS:

Large inventory, available for immediate shipment.



rebuilt Banbury mixers are backed by Skinner Engine Company's 90-year history of high-precision machining in the heavy goods industry—your guaranty of the finest of engineering and workmanship.

Rotors, side jackets, rings, bearings, end frames, thrust nuts, door tops, connecting gears—all are carefully examined by skilled technicians and magna-fluxed to detect hidden defects. Each worn part is either replaced by a new part or is restored to its original size and contour. All wearing surfaces are thoroughly hard surfaced.

When your Banbury mixer needs repairing or rebuilding, give us a call—one of our engineers will visit your plant and inspect your installation—without cost or obligation to you.

SKINNER · ENGINE · COMPANY



RUBBER MACHINERY DIVISION
TELEPHONE ERIE 2-3661

ERIE 6 · PENNSYLVANIA



COPPO[®]

means good service in cold rubber . . .

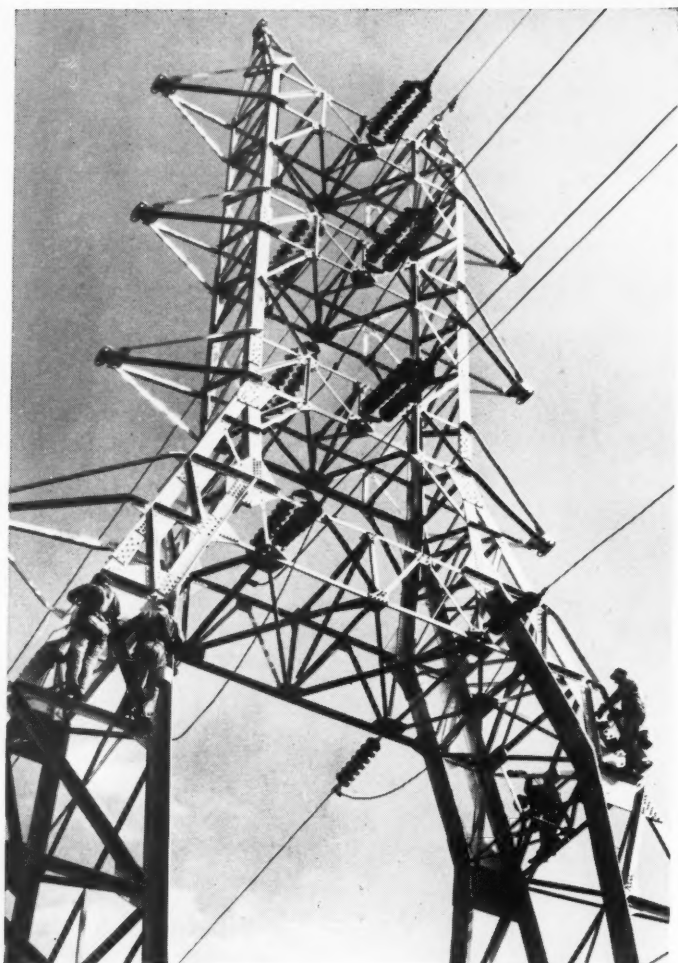
and good service includes special attention to
EMERGENCY ORDERS.

pioneering • uniformity • well-packaged • high quality

COPOLYMER RUBBER & CHEMICAL CORPORATION • BATON ROUGE 1, LOUISIANA



COLD RUBBER SPECIALISTS



HIGH POWER production

for Fast and Smooth
Extrusion of Electrical
Insulation and
Jacketing Compounds!

Marbon "8000-AE"®

REINFORCING HIGH STYRENE RESIN

The Superior Electrical Grade Resin!

- SUPERIOR ELECTRICAL PROPERTIES
- LESS SCORCH
- INCREASED TOUGHNESS
- GREATER TEAR-RESISTANCE

America's foremost electrical insulation suppliers have demonstrated the complete dependability of Marbon 8000-AE for fast mixing; smooth, easy extrusion and shrink-free calendering of electrical insulations, jackets and sheet stock. Marbon 8000-AE has proved time and again to be the superior electrical grade resin because it has all the reinforcing properties of world-famous Marbon 8000-A.

Get the Facts...

Write **TODAY** for
complete **TECHNICAL**
LITERATURE



MARBON CHEMICAL

Division of BORG-WARNER

GARY, INDIANA

MARBON . . . It BLENDS as STRENGTHENS as it IMPROVES

NEW RUBBER SOLVENT

CUTS

DRYING TIME!

ESPESOL 165's Narrow boiling range reduces handling time— improves quality of end product!

NEW ESPESOL 165 aliphatic solvent offers rubber processors a *narrow boiling range* of 165 to 225 degrees F with a low-odor factor. This narrow cut with its low end point offers a much shorter drying time and a substantial increase in production. ESPESOL 165's higher initial boiling point offers less evaporation loss and permits greater solvent recovery. The solvent's unusually short distillation range offers two additional benefits: 1. Improved quality of end products. 2. Reduction in amount of solvent used.

Because the use of ESPESOL 165 can reduce handling time, increase production and improve the quality of your end products, this outstanding new solvent deserves the consideration of your organization. Send for the complete ESPESOL 165 story. Brochure containing characteristics and properties yours free on request. (No delivery problems! Eastern maintains adequate stocks of this unique product at all times.)

EASTERN STATES PETROLEUM & CHEMICAL Corporation

(Formerly Eastern States Chemical Corporation)

P. O. Box 5008 • Houston 12, Texas • Phone WAlnut 3-1651

Chicago Office: 1011 Lake Street, Oak Park, Ill.,
Phone VIlage 8-5410

New York Office: 10 Rockefeller Plaza, New York, N.Y.,
Phone CIRCLE 7-2520

Cleveland Office: 20800 Center Ridge Road, Cleveland, O.,
Phone EdIsOn 3-0188



Eastern States Petroleum & Chemical Corporation
P. O. Box 5008, Dept. RW 4-B, Houston 12, Texas

Please send me free booklet on the characteristics and properties of Espesol 165.

NAME _____

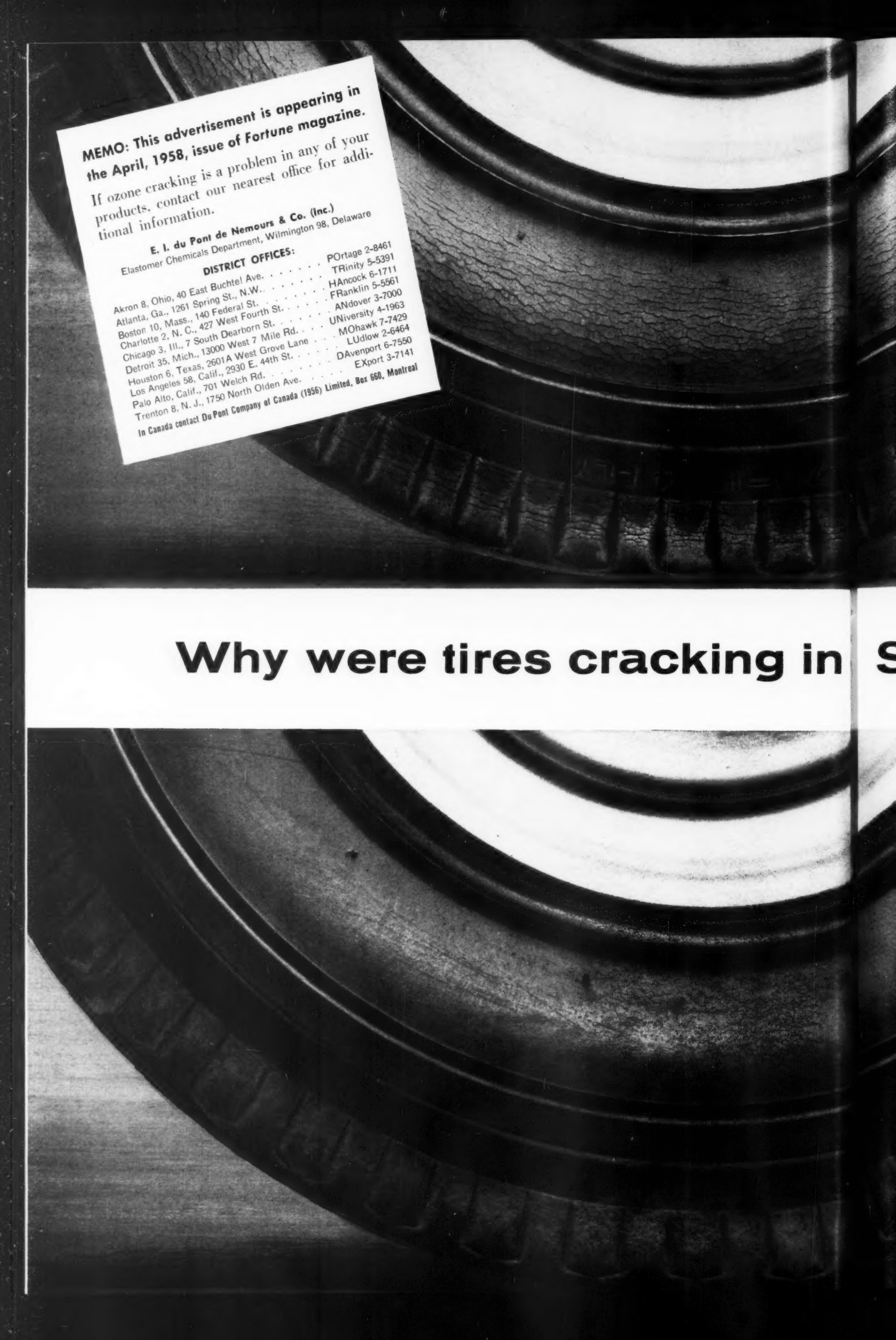
FIRM _____

ADDRESS _____

CITY _____

ZONE _____

STATE _____



MEMO: This advertisement is appearing in the April, 1958, issue of Fortune magazine.

If ozone cracking is a problem in any of your products, contact our nearest office for additional information.

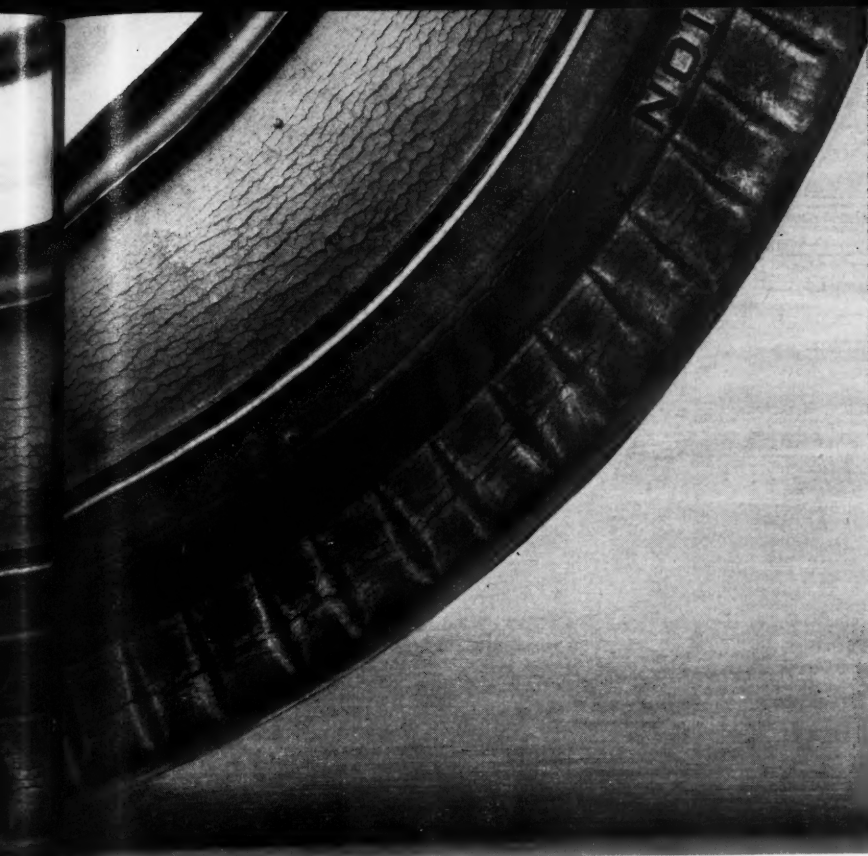
E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Department, Wilmington 98, Delaware

DISTRICT OFFICES:

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Atlanta, Ga., 1261 Spring St., N.W.	TRinity 5-5391
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Palo Alto, Calif., 701 Welch Rd.	DAvenport 6-7550
Trenton 8, N. J., 1750 North Olden Ave.	EXport 3-7141

In Canada contact Du Pont Company of Canada (1956) Limited, Box 650, Montreal

Why were tires cracking in S



n Southern California?



THE premium-grade passenger tire shown in the upper unretouched photograph bears mute evidence of what has been an aggravating problem for Southern California motorists and tire retailers alike: sidewall cracks that ruin a tire's appearance and shorten its life long before the tread wears out.

The tire shown, for example, has only 30% tread wear—yet the sidewall is already deeply cracked. The cause? *Ozone*—a form of oxygen that is especially destructive to ordinary rubber. While ozone is present everywhere, local atmospheric conditions permit it to accumulate in the air in abnormal amounts in Southern California. In such concentrations, ozone quickly destroys ordinary rubber products.

But this problem has now been solved. A leading tire manufacturer has developed a new type of premium tire that has already proved its ability to eliminate ozone crack failures. Retail sales records verify that customer complaints on ozone cracks have been eliminated.

The lower photograph (also unretouched) illustrates this fact. This tire was run approximately the same length of time as the cracked tire above. Notice how its sidewalls are free from cracks—how new it looks.

Basically, the big difference in these tires is that the new one has sidewalls made with *neoprene*—a Du Pont synthetic rubber whose resistance to ozone has been proved through years of use in many rubber products. With this background, the tire manufacturer felt neoprene was the answer—and it was!

A startling improvement in performance? Yes. But then, Du Pont has developed a *family* of synthetic rubbers just for that purpose. Neoprene offers a balanced combination of properties for many different uses. *HYPALON** is the answer for many special causes of rubber failure. On the horizon is *VITON**, a fluor elastomer, which can withstand temperatures over 500° F.

E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department, Wilmington 98, Delaware.



REG. U. S. PAT. OFF.

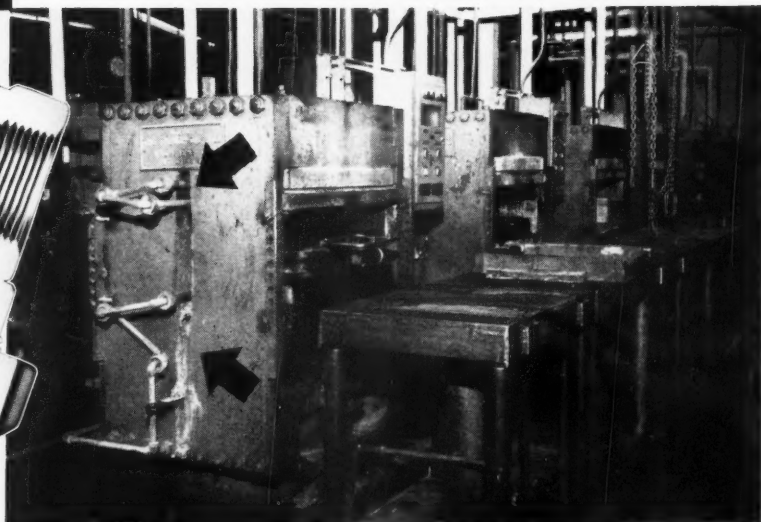
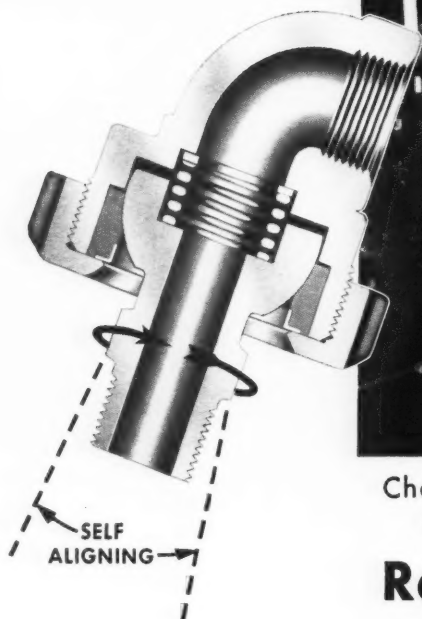
NEOPRENE

**Better Things for Better Living
... through Chemistry**

*Registered Du Pont Trademarks

BARCO

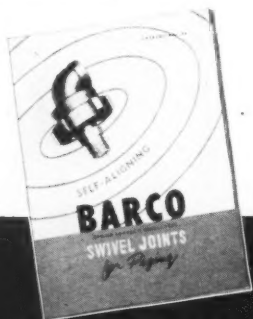
Self-Aligning SWIVEL JOINTS



Chardon Rubber Co.
Chardon, Ohio

—Ends Hose Replacement Nuisance!

1. **IMPROVED SEAL**—Barco's new No. 11CTS gasket is amazingly long wearing! Does not bake hard. Ideal for steam and water service. Does not cause excess wear on other parts.
2. **LEAKPROOF, HOT OR COLD**—Joints stay tight regardless of pressure or temperature.
3. **SELF-ALIGNING**—10° side flexibility. This Barco feature saves piping time, cuts costs, and insures perfect performance.
4. **ENGINEERING RECOMMENDATIONS**—Send for a copy of Catalog No. 265C and installation drawing 10-52004.



**SEND FOR NEW
BULLETIN No. 265C**

FORTY-THREE multiple platen presses running 24 hours a day and cycling every 3 to 5 minutes, 6 days a week, can add up to a **BIG** maintenance responsibility! In checking records, Alex J. Keller, Plant Manager, The Chardon Rubber Company, Chardon, Ohio, found he was having a continual series of emergencies with steam hose connections breaking unexpectedly.

Because of loss of time, loss of steam, loss of production, and cost of hose, Mr. Keller decided to make a test installation using Barco Type S Swivel Joints WITH NEW 11CTS TEFLON SEALS, and all-metal dog-leg piping. The test was a real revelation!

Today, Chardon Rubber Co. has all 43 presses equipped with Barco Swivel Joints. The piping is neater and more compact than hose. In three years' time, no blow-outs have occurred. There has been no maintenance time on the 387 joints since installation.

**BARCO SWIVEL JOINTS ARE A GOOD INVESTMENT!
FIND OUT ABOUT THEM NOW.**



BARCO MANUFACTURING CO.
510E Hough Street • Barrington, Illinois

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints
In Canada: The Holden Co., Ltd., Montreal

Of Course, SILENE-EF Improves Products!

and I Should Know...

Perhaps he does, too, for his "mommy" uses many rubber, neoprene and vinyl products for his comfort that have been given extra reinforcement with SILENE EF . . .

For Better Tensile Strength . . .

In Products of Natural Rubber and GR-S SILENE EF assures improved elongation, higher tensile strength, better hardness and tear-resistance.

For Products In Colors . . .

GR-S, Nitrile, Neoprene or Vinyl — SILENE EF is the versatile white reinforcing pigment that gives hardness, high tear-resistance and superior tensile without sacrifice of color quality.

And As An Acid Acceptor . . .

SILENE EF serves as an acid acceptor and mild heat stabilizer in vinyl resins. In films and sheet stock it can be used in proper amounts without reduction of physical properties or translucency of film.



SILENE-EF

**Assures
improvement
and better
sales—making
properties in
many products
of rubber,
neoprene and
vinyl.**



Write for bulletin giving complete data.
SILENE EF is a product of Columbia-Southern Chemical Corp.

HARWICK STANDARD CHEMICAL CO.

60 SOUTH SEIBERLING STREET, AKRON 5, OHIO

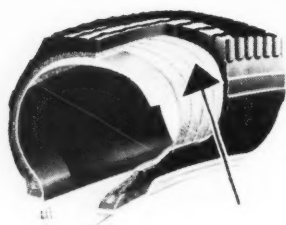
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661 BOYLSTON STREET

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CHICAGO 25, ILLINOIS
2724 W. LAWRENCE AVE.

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OLD GUNTERSVILLE HWY.

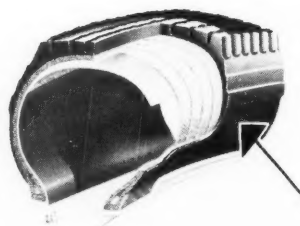


AND

COMING
GOING



ZINC OXIDE SERVES THE RUBBER INDUSTRY WELL



On the 'coming' side, zinc oxide serves the rubber industry because rayon serves it. Rayon is a large consumer of zinc oxide. Rayon finds in the rubber industry its largest single outlet, particularly in the manufacture of passenger car tires. The records show that 99.2% of 1957 passenger car models have rayon cord tires as original equipment.

On the 'going' side, rubber itself is the largest consumer of zinc oxide for processing. As fabricated rubber products go out in the world of commerce zinc oxide can claim more than a modest share in their production. It is essential for the processing of rubber.

St. Joe produces more than thirty different grades of zinc oxide, each has special characteristics and properties. Our technical staff with its well-equipped laboratory is at your service to assist in any application problem.

ST. JOSEPH LEAD COMPANY

250 PARK AVENUE, NEW YORK 17, NEW YORK

The Largest Producer of Lead in the United States



Let's sit down and talk things over

Here at Adamson we've been doing something that we believe is rather unique in the industry. Every now and then a manufacturer of rubber or plastics has expressed a desire to discuss certain problems pertaining to calendering or calendering equipment, and we have invited him and his associates to our conference room for a roundtable session with our staff. No one dreamed the idea up—it just grew. Some of the largest manufacturers in the industry have been our guests and have described the meetings as helpful and enlightening.

Certainly, since we build calenders and related equipment, these clinics have been of great value to us. And because we believe that a free exchange of opinions and ideas is the surest way to promote progress and improvement in any industry, we extend to you and your company a cordial invitation to our conference room. Perhaps, like the famous riddle of which came first, the chicken or the egg, many questions will have to be left unanswered, yet the benefits to be derived from a free discussion of our common problems cannot fail to be mutually helpful.

Why not phone or write us for a conference date? The obligation will be all ours.



Adamson United Company

730 Carrol Street • Akron 4, Ohio

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BETTER MACHINES AND PROCESSES FOR
BETTER RUBBER AND PLASTICS PRODUCTS



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ON
WHITTAKER**
"The Talc House"
FOR...

MAGLITE[®]-D*

THE NEOPRENE COMPOUNDER'S STANDARD

Maglite D is a dense, free-flowing, active, extremely fine particle size magnesium oxide produced by a patented process . . . rigidly controlled for uniform activity, chemical and physical properties.

By activity, we mean affinity for hydrogen ion. The controlled large surface area of the porous, spongy particles, gives a uniformly high capacity for instantaneous acid acceptance. Maglite D is uniform.

The activity of Maglite D gives the most scorch protection consistent with a practical cure-rate, and the best balance of physical properties before and after aging.

The uniformity of Maglite D assures the neoprene compounder that he will obtain a product which does not vary within a shipment, or from one shipment to another. Maglite D is uniform.

OTHER GRADES OF MAGNESIUM OXIDE FOR USE IN COMPOUNDING NEOPRENE, HYPALON, AND BUTYL

MAGLITE K[®]*

MAGLITE M[®]*

MAGLITE L[®]*

*PRODUCED BY MERCK & CO., INC., MARINE MAGNESIUM DIV.

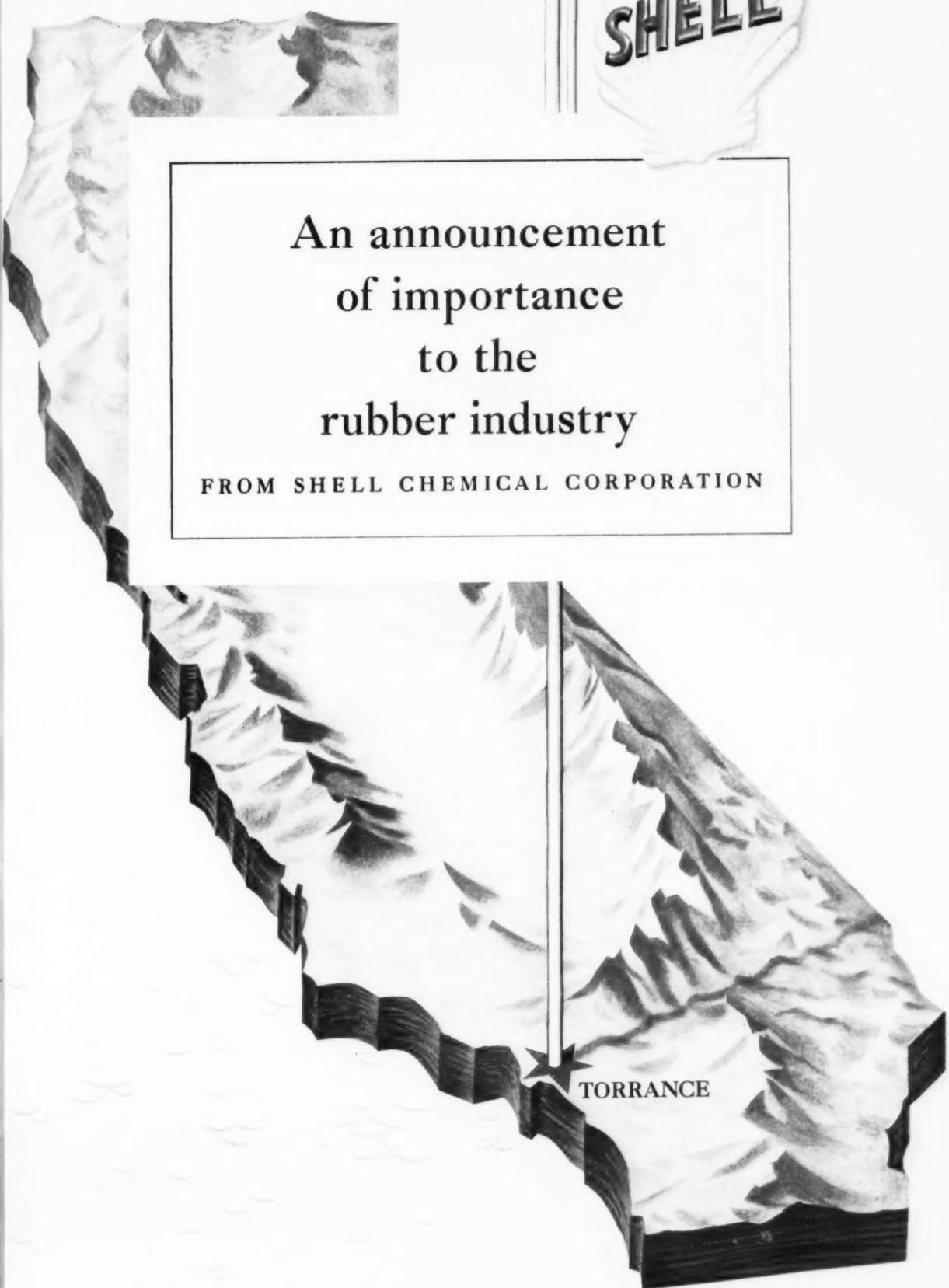
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Tellurium
Whiting



SHELL



**An announcement
of importance
to the
rubber industry**

FROM SHELL CHEMICAL CORPORATION

TORRANCE

Shell Synthetic Rubber is now available in the FLOTAINER*

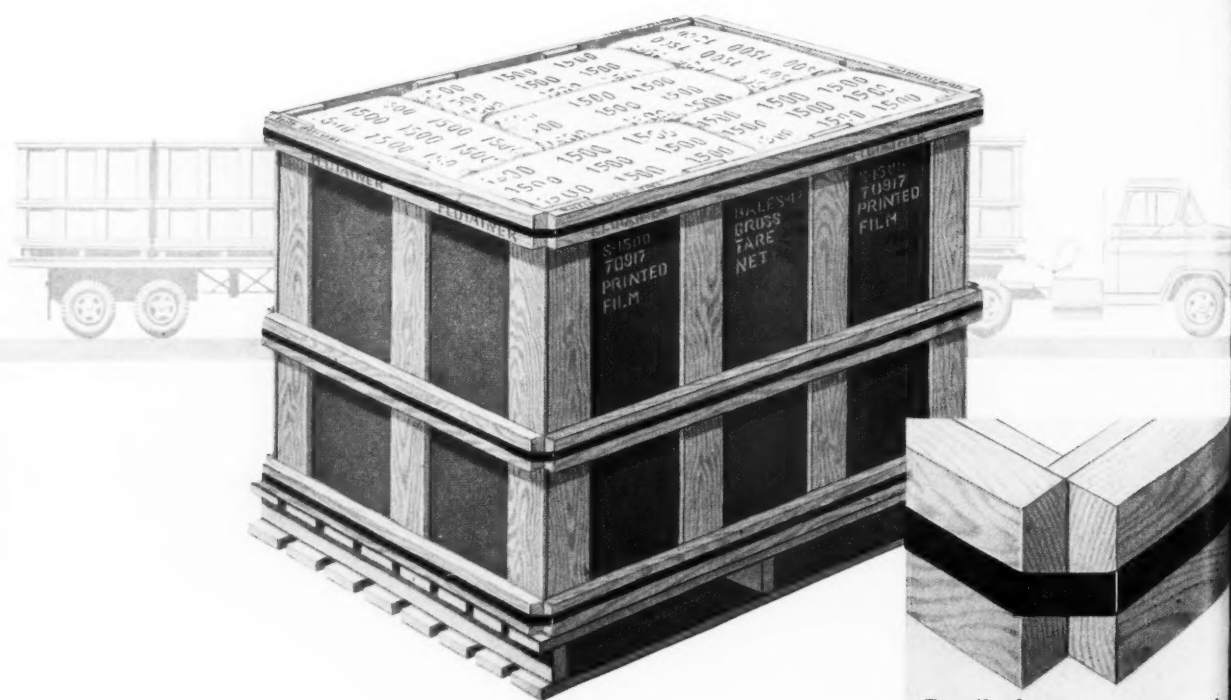
A practical answer to the cold flow
problem in shipping and storing synthetic rubber

FOR many years industrial users of general-purpose synthetic rubber have fought handling, storage and product contamination problems resulting from cold flow.

Now—after months of actual on-the-job testing—Shell introduces the Flotainer*—a major step forward in the application of modern packaging and handling methods.

The FLOTAINER* is a strong, lightweight, steel-strapped wooden container reinforced at strategic points to withstand the heavy pressure of settling bales. By controlling cold flow, it prevents bale deformation and film rupture during the critical storage and shipping periods.

*Shell Chemical Trademark. Patents pending.



Ready for shipment. On its returnable pallet, the Flotainer contains 42 film-wrapped bales . . . 1½ tons of Shell synthetic rubber.

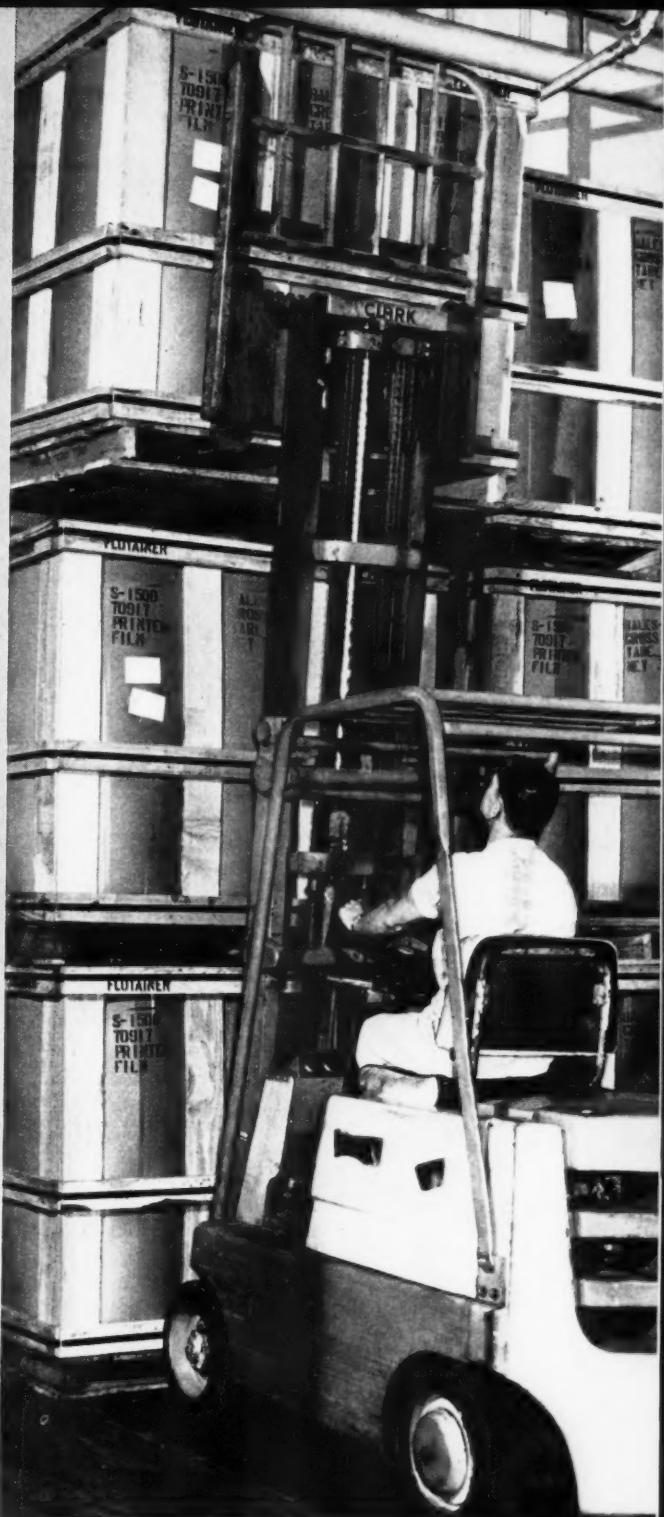
Detail of corner construction
3 steel straps hold sides together.
3 snips . . . and the sides fall off.



Easy to unload. Standard fork-lift equipment unloads a flat-bed truck in less time than it takes to clear the gate house in some plants.



Easy to open. Sides and cardboard liner are easily removed. Side panels stack neatly for return trip.

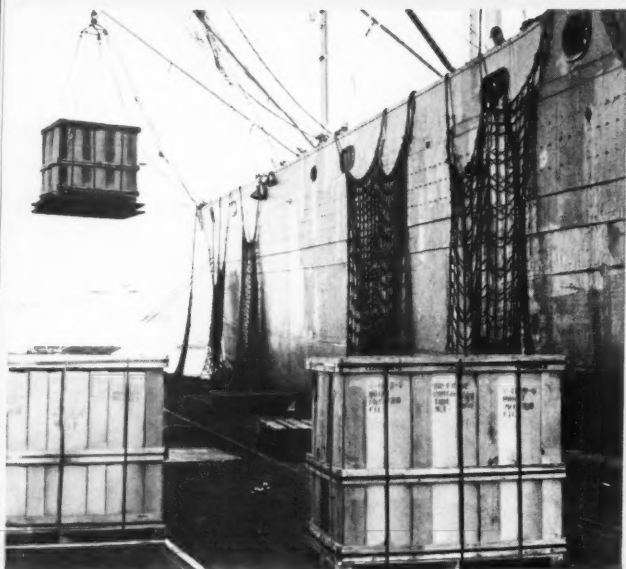


Easy to store. Three-high stacking puts twenty tons of rubber on less than 100 square feet of floor space.

◀ Easy to move. Pallet load retains compacted shape for some time after removal of sides. Nothing but the pallet and a single sheet of heavy paper goes to the Banbury room with the rubber.



En route by truck, Shell synthetic rubber in Flotainers leaves Shell's Torrance plant. Fifteen Flotainers—over 20 long tons of rubber—on a single flat-bed truck.



➤ En route by freighter, a Flotainer loaded with Shell synthetic rubber is hoisted easily to the ship's hold for an overseas destination.

En route by railroad, Flotainers provide security against deformation and contamination in transit, simplify loading and unloading.



THE FLOTAINER was developed at Shell's Torrance, California, plant

Here Shell Chemical produces a wide range of butadiene-styrene synthetic rubbers. These include hot, cold, oil-extended and black masterbatch rubber, as well as hot and cold latices. Our Technical Service Laboratory is ready to work with you in determining which Shell rubber best serves your purposes.

Get the complete story about Shell synthetic rubber. Phone or write for a catalog—or visit us at Torrance, California.

SHELL CHEMICAL CORPORATION

Synthetic Rubber Sales Division
P.O. Box 216, Torrance, California
DAvis 3-3030 FAculity 1-2340

SHELL

April, 195

Will your products look old before they're sold?



not if you use VELSICOL X-37 Hydrocarbon Resin!

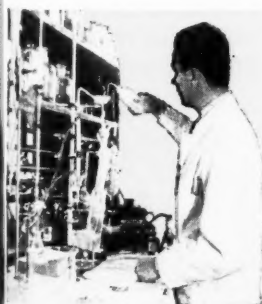
VELSICOL'S X-37 RESIN used in white or light colored rubber products maintains resistance to ultra violet discoloration. Recipes that contain X-37 keep their light, fresh, appealing colors. On the shelf, on display, and in use, they retain color character that appeals to consumers and keeps them coming back for more! X-37 also increases flex, and you can use it in shoe soles, household products, light colored flooring tile, and many other rubber compounds. Get the facts now, without cost or obligation!

MAIL THIS COUPON TODAY FOR TECHNICAL INFORMATION AND TEST SAMPLES



LOOK FOR THIS MAN

...your Velsicol representative who can help you make better products for less!



VELSICOL

330 E. Grand Ave., Chicago 11, Ill.

International Representative:
Velsicol International Corporation, C.A.
P. O. Box 1687 • Nassau, Bahamas, B.W.I.



VELSICOL CHEMICAL CORPORATION

(RW-48)

330 East Grand Avenue, Chicago 11, Illinois

- ☐ Please have a salesman call to discuss Velsicol X-37 resins.
- ☐ Please send a sample for pilot plant use.
- ☐ Please send technical literature.

Name

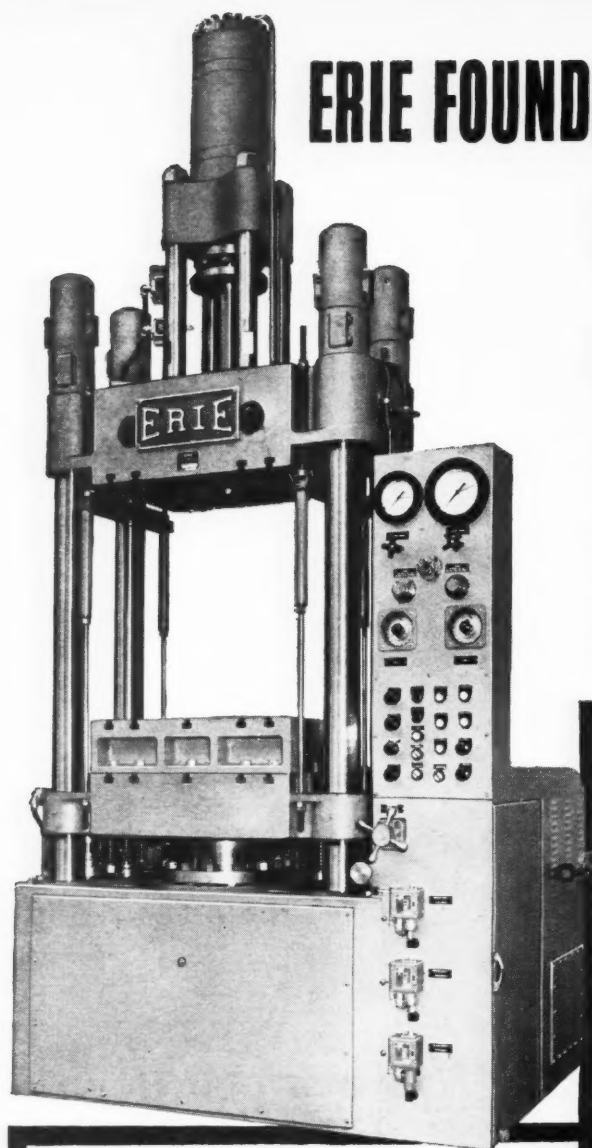
Company

Address

City Zone State

ERIE FOUNDRY HYDRAULIC PRESSES

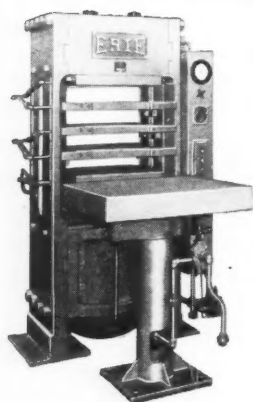
for MOLDING RUBBER and PLASTICS



Hydraulic presses, designed and built by Erie Foundry Company are precision presses in every sense of the word . . . tonnages are accurate and precisely applied, platen temperatures are closely controlled, and molding cycles perform at split second timing. Erie Foundry Hydraulic Presses are flexible too . . . readily adaptable to almost any molding job. Write for complete information on these presses or on the complete line of Erie Foundry rubber and plastic hydraulic presses.

TRANSFER and COMPRESSION MOLDING PRESS

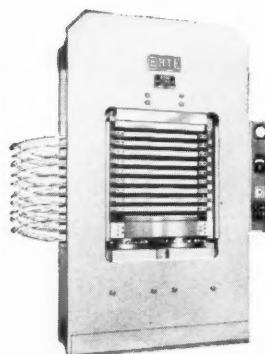
A flexible press for both compression and transfer molding is this 200 ton self-contained semi-automatic Erie press. This machine is equipped with a 55 ton transfer cylinder which can be timed separately from the main ram, as well as knock out cylinders on the bolster and a mechanical knock out for the top mold. Automatic cycling can be easily arranged to mold almost any product.



STRAIN PLATE PRESS for MINIMUM DEFLECTION

The platens stay parallel within .002" on this 314 ton press built of low-stress construction throughout. This press can be converted to transfer molding if desired.

We built the hydraulic lift table, too.



HOT PLATEN PRESS OF ECONOMICAL DESIGN

This 800 ton press is compact and rigid. Accurate platen alignment is maintained with minimum deflection over entire range of platen temperatures.

ERIE

Hydraulic Press Division

ERIE FOUNDRY CO. ERIE 8, PA.

SINCE 1895 THE GREATEST NAME IN HYDRAULIC PRESSES.

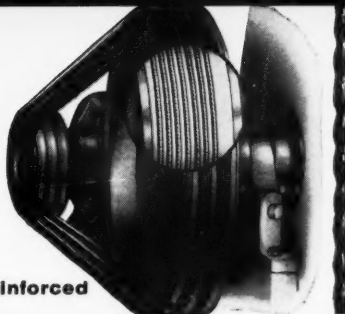
RUBBER WORLD



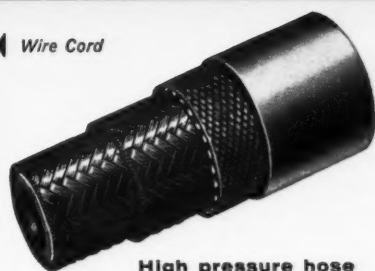
Tire bead wire



Wire-reinforced V-belts



Wire Cord

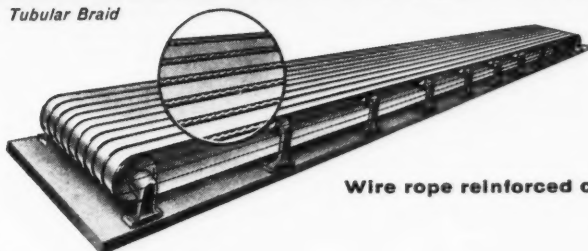


High pressure hose



Tubular Braid

Flat Braid



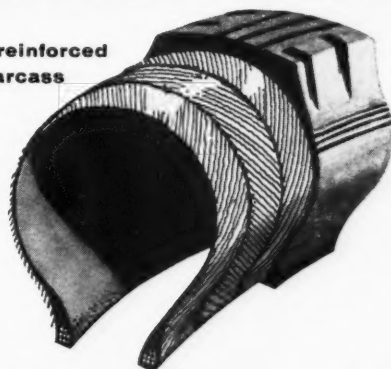
Wire rope reinforced conveyor belts

Pierce Tape

Rotary drilling hose



Wire reinforced tire carcass



Vacuum hose



Webless



WIRE SPECIALIZATION *for compatibility with rubber*

Never hesitate to contact National-Standard for technical help on meeting your wire requirements. As you may already realize, no other company has devoted so many years, or so much concentrated research and development, to the teaming of wire with rubber!

This specialized experience can work to your

advantage . . . in determining exactly the right wire, cord, braid or tape . . . in helping you work out details of application, fabrication, wire size, strength, finish, adhesion and the many other variables.

So please remember, National-Standard service is always at *your* service.

NATIONAL



STANDARD

DIVISIONS: NATIONAL - STANDARD, Niles, Mich.; tire wire, stainless, music spring and plated wires • WORCESTER WIRE WORKS, Worcester, Mass.; music spring, stainless and plated wires, high and low carbon specialties
WAGNER LITHO MACHINERY, Secaucus, N. J.; metal decorating equipment • ATHENIA STEEL, Clifton, N. J.; flat, high carbon spring steels • REYNOLDS WIRE, Dixon, Ill.; industrial wire cloth

Better Help Assured by eliminating built-in confusion

RUBBER WORLD believes you would like to know about the bi-partisan Hoover Commission's recommendation to put business management methods into government departments operating under the Civil Service System

Departments using the Civil Service System operate under a balance that requires

1) politically appointed policy-making officials and 2) trained, skilled non-political staff members to carry out policy.

Career personnel, who know most about a department's operations, have the least to say about policies and programs. Non-career people, who know least about a department's operations, have the responsibility for operating decisions.

Here's what the Commission learned: There is no clear-cut division of labor between non-career (temporary) officials and career (permanent) personnel, and the result is inevitable loss of efficiency.

Genuine ability is often unrecognized...and incapable people are sometimes kept on the payroll too long...

Turnover in personnel is too high... departments are losing the better people at an alarming rate...

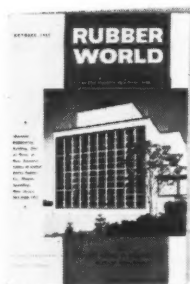
Result of the Commission's analysis is the recommendation of a new and top flight career "Senior Civil Service"...a few thou-

sand key administrators, scientists and technicians to be given status, rank, and better pay incentives. Such a plan, the Commission feels, would attract more capable young people, help retain experienced personnel, and improve the continuity and the caliber of work done. Savings in dollars would be considerable; savings in efficiency would be tremendous.

What you can do

This magazine, a member of *Bill Brothers Publishing Company*, presents this brief background as a service to its business readers. If you'd like more detailed information, the coupon below will start it on its way to you.

Meanwhile you should know that in this session of Congress H.R. 8207 awaits action by the House Post Office and Civil Service Committee, and S. 2290 by the Senate Post Office and Civil Service Committee. These bills would establish a Senior Civil Service to be administrated by an independent board of highly competent private citizens. If this makes sense to you, let your Congressmen know how you feel.



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386 Fourth Avenue, New York 16, N. Y.

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PLASTICS TECHNOLOGY • PREMIUM
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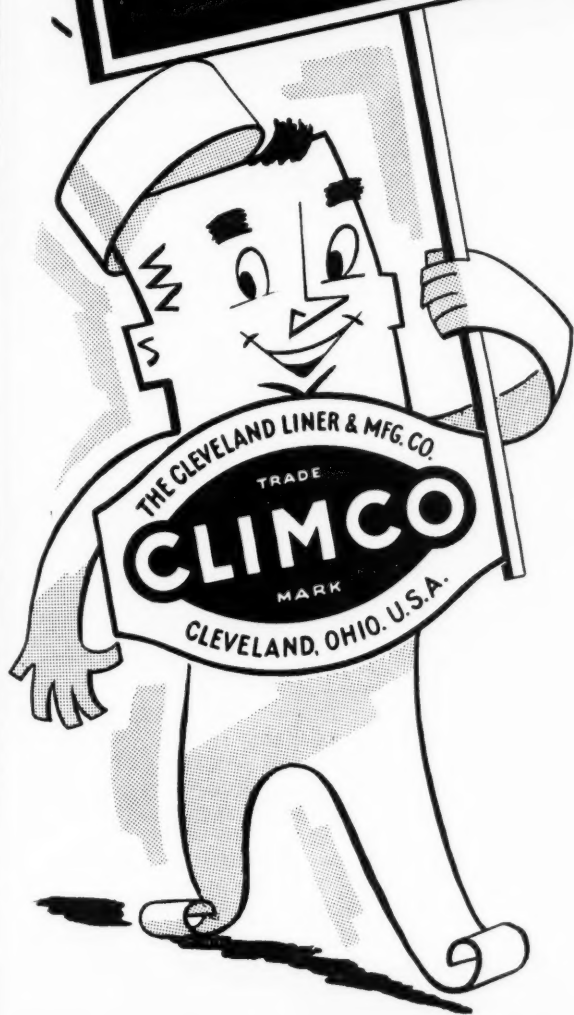
Yes, I would like to receive, without obligation, a membership card for the *Citizens Committee for the Hoover Report* and a copy of the *Committee Member's Handbook*, *Reorganization News*, and other current cost-cutting legislative information.

name _____
title _____
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MR. CLIMCO
SAYS . . .

CLIMCO LINERS

*save time at the bias
cutter and cutting table*



Perfect separation of stock and liner is all important during these operations—for stock adhesions at either point cause expensive down time. You can

avoid such production headaches by using Climco Processed Liners that can be readily peeled from the stock without sticking.

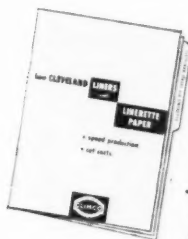
Climco Processing of your liners assures many other profitable advantages: Liner life is greatly increased, tackiness of the stock is preserved, and gauges are more easily maintained. Latitude in compounding is enlarged, lint and ravelings are eliminated and horizontal storage is facilitated.

Since 1922 Climco Processed Liners have proved their worth to the rubber industry. Give them a trial in your plant.

THE CLEVELAND LINER & MFG. CO.

5508 Maurice Ave. • Cleveland 27, Ohio, U.S.A.

Cable Address: "BLUELINER"



**ILLUSTRATED
LINER BOOKLET**

Tells all about Climco Liners and Linerette and how to get better service from liners. Write for your copy now.

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PROCESSED LINERS

Serving the Industry Since 1921

LINERETTE
INTERLEAVING PAPER
Treatment Contains
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Samples on Request

CUT MIXING TIME

**FROM DAYS
TO HOURS**

Struthers Wells **Rubber Cement Mixer**

Struthers Wells Rubber Cement Mixers combine high velocity and streamlined flow with the cutting action of high speed propellers to obtain unprecedented mixing speed with ease of cleaning. Available in capacities from 5 to 1500 gallons, jacketed or plain, of any weldable metal. These mixers save time, labor, power and solvent. Vapor-tight "Quick Opening" doors and explosion-proof motors minimize fire hazards.



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REDUCE FIRE HAZARDS!

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WARREN, PA.

**Struthers
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and Titusville, Pa.**

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HOW THE **SILICONES MAN** HELPED... BUILD THE PATTERN OF A TIRE TREAD

Tire tread designs are patterns with a purpose. Years of research by the tire industry has proven every slot, every angle to be the most efficient . . . to offer the most in road holding with a minimum of wear. This is no small contribution to safer, surer transportation.

Those thousands of thin grooves are difficult to make . . . still, they provide the "biting edge" for safe stops. Molded in standard equipment with extremely thin section molds, the grooves are made possible because of the easy release properties of UNION CARBIDE Silicones. And, production is increased, rejects are reduced. One manufacturer, after eight years of experience, states: "Silicones reduce blemishes on treads, permit complicated

treads not possible without silicones, and eliminates mold cleaning."


This is another example of how the UNION CARBIDE Silicones Man has helped solve an "impossible" problem . . . why UNION CARBIDE is one of the leading suppliers of silicone release agents for the rubber industry. For details, contact our distributor, C. P. Hall Co., with offices in Newark, N. J., Chicago, Ill., Akron, Ohio, Memphis, Tenn., and Los Angeles, Calif., or write Dept. RW-4, Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.



SILICONES

The term "Union Carbide" is a registered trade-mark of UCC.

In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Toronto 7, Ontario.



inert strength . . .

Piccolastic

resins

Chemically inert and color stable, Piccolastic Resins provide a tough and versatile thermoplastic material where outstanding water and chemical resistance are required.

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Clairton, Penna.



Distributed to the Rubber Industry by the HARWICK STANDARD CHEMICAL CO., Akron 6, Ohio

Manufacturers of CANARY LINERS

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Cotton Fabrics as per Government
Specifications. *Write or Wire for Samples
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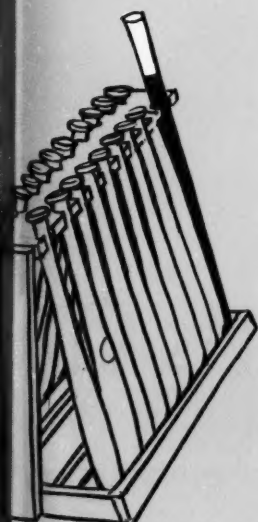
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WORLD



TEAM UP PHILPRENE* WITH PHILBLACK*

for easy processing and
superior abrasion resistance!

Here's the pitch! When you use Philprene and Philblack together you can depend on championship performance every time! They bring out the best in each other! The correct combination of rubber polymer and carbon black can help you turn out better rubber products. More easily, too! Consult your Phillips technical representative for optimum results.



*A Trademark

YOU GET BIG LEAGUE PERFORMANCE WHEN YOU USE PHILPRENE* AND PHILBLACK* TOGETHER!



LET ALL THE PHILBLACKS WORK FOR YOU!

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Philblack A, Fast Extrusion Furnace Black. Excellent tubing molding, calendering, finish! Mixes easily. Disperses heat. Non-staining.

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Philblack O, High Abrasion Furnace Black. For long, durable life. Good conductivity. Excellent flex life and hot tensile. Easy processing.



I

Philblack I, Intermediate Super Abrasion Furnace Black. Superior abrasion. More tread miles at moderate cost.

E

Philblack E, Super Abrasion Furnace Black. Toughest black yet! Extreme resistance to abrasion.

CURRENT PHILPRENE POLYMERS

	NON-PIGMENTED	PIGMENTED WITH PHILBLACK
		
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COLD	PHILPRENE 1500 PHILPRENE 1502 PHILPRENE 1503	PHILPRENE 1600 PHILPRENE 1601 PHILPRENE 1605
COLD OIL	PHILPRENE 1703 PHILPRENE 1706 PHILPRENE 1708 PHILPRENE 1712	PHILPRENE 1803 PHILPRENE 1805



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District Offices: Chicago, Providence and Trenton
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FOR RUBBER & PLASTIC

• This Process Laboratory in Akron, Ohio is a birthplace of new ideas in rubber and plastic. Here we develop basic machines, such as automatically operated mills and processing screw extruders to:

1. Produce more products per man-hour.
2. Produce products of higher quality.
3. Produce products with new and different material formulations.
4. Produce new end products.

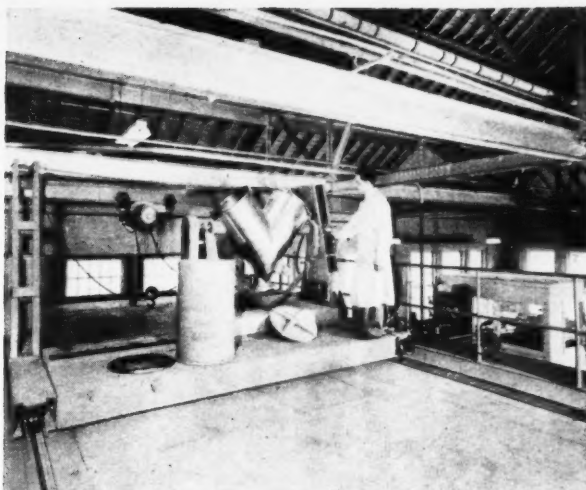
New materials, new processes and new products require new machines and new thinking. Wherever your horizons lead you, this Laboratory could possibly supply some of the answers. Your new idea or idea yet to be born can mature here. Outline your thinking by phone or letter and we will go to work.

AETNA • STANDARD

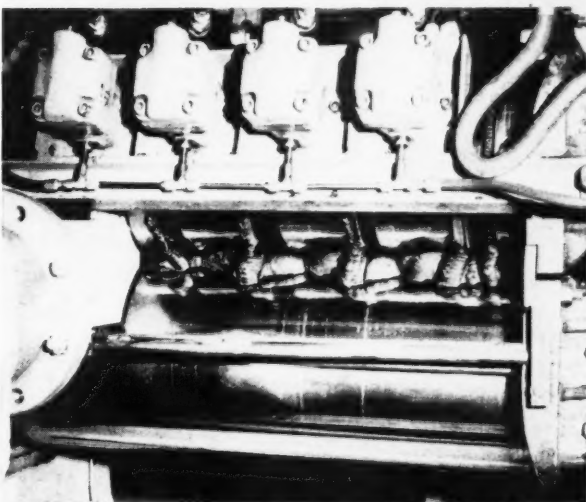
ENGINEERING COMPANY

PITTSBURGH, PENNSYLVANIA

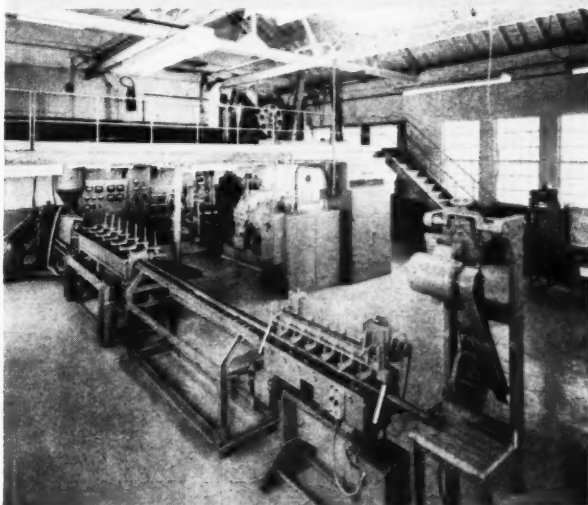
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HALE & KULLGREN, INC.
Akron, Ohio



Raw material handling may include blending, automatic weighing, and controlled feeding.



The Continuous Automatic Mill dispenses pigments and plasticizes uniformly without manual attention.



We specialize in screw machines for processing, blending, reclaiming, or devolatilizing.



(formerly Tenamene 30 and 31)

Eastozone

cuts
cost of
ozone
protection

Rubber products require safeguards against the serious deteriorating effects of ozone. Yet, you may be spending more than you need spend for this protection.

Eastozone—Eastman rubber antiozonants—guard against ozone attack more effectively at *lower cost* than do other types of commercially available antiozonants.

By using Eastozone in rubber recipes, compounds often can cut antiozonants concentration in half and get equal ozone protection, measured by static or dynamic ozone exposure tests. At current prices, this lower concentration can mean a saving of as much as 20¢ on your antiozonant dollar.

Eastozone antiozonants are easily incorporated into the rubber formula during processing. They slowly exude to the

surface of the finished rubber product, affording long-lasting protection against checking and cracking caused by atmospheric ozone.

For economical and effective ozone protection, specify Eastman antiozonants for your rubber recipes. Ask your Eastman representative today for samples of Eastozone 30 and Eastozone 31 for evaluation by your laboratory staff, or write to Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Company, Kingsport, Tennessee.

Chemical Description of Eastman Antiozonants

Eastozone 30.....	N,N'-di-2-octyl p-phenylenediamine
Eastozone 31.....	N,N'-di-3-(5-methylheptyl) p-phenylenediamine

Eastozone

(formerly Tenamene 30 and 31)

Eastman Rubber Antiozonants

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tennessee; New York City; Framingham, Massachusetts; Cincinnati; Cleveland; Chicago; St. Louis; Houston. **West Coast:** Wilson Meyer Co., San Francisco; Los Angeles; Portland; Salt Lake City; Seattle.

Ameripol "crumb" rubber pours directly to mixers, eliminates need for cutting or extruding at The Garlock Packing Company, Palmyra, N.Y., manufacturer of asbestos sheet packing for high pressure steam lines.

BEFORE



AFTER



Ameripol
RUBBER

eliminates two processing steps; cuts mixing time in half!

Processing costs really tumbled when The Garlock Packing Company switched to Ameripol "crumb" polymers as the adhesive filler for asbestos sheet packing. New "crumb" Ameripol goes right into the mixer with no prior processing. Formerly, it was necessary to cut and extrude rubber to convert it to spaghetti-like form before mixing.

The rubber is dissolved in a solvent to mix with asbestos and produce a uniform mixture before sheeting. "Crumb" Ameripol with its small particle size and extra porosity soaks up solvent faster. Mixing time is cut from 3 hours to 1½.

This new form of butadiene-styrene rubber was developed by Goodrich-Gulf research for just such savings in processing and equipment. "Crumb" form hot polymers are available in production quantities to cut your processing costs, too.

Call us for your requirements

**Goodrich-Gulf
Chemicals, Inc.**

3121 Euclid Avenue • Cleveland 15, Ohio

THE NAME TO REMEMBER FOR QUALITY BACKED BY YEARS OF RESEARCH AND EXPERIENCE

April, 1958

57

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RED IRON OXIDE colors
you can *Relax...*



when you specify
WILLIAMS

R-1599 R-2200
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R-2899 R-3200

and the **KROMA REDS**

*... because you know you're getting
absolute uniformity of pigment product!*

Each is manufactured to rigid specifications for copper and manganese content, pH value, soluble salts, fineness, color, tint and strength by controlled processes and with special equipment.

If you haven't already done so, try these finest of all oxide colors. Our 79 years of experience in the pigment business is your guarantee of absolute uniformity of pigment product.

*"See your Williams representative"
or write direct for complete technical data*

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C. K. Williams & Co., Easton, Penna.

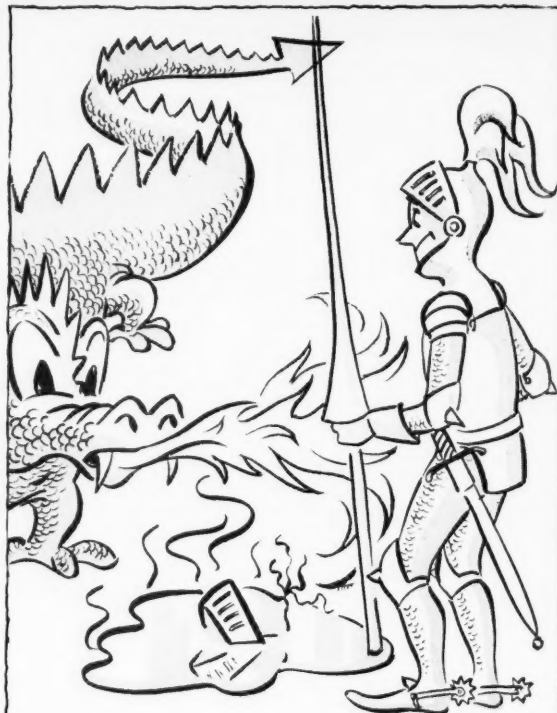
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WILLIAMS

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EASTON, PA. ST. LOUIS, ILL. EMERYVILLE, CAL.



Best scorch protection yet...

MAGLITE D

The performance-proved magnesium oxide

Recent tests in the Merck Rubber Research Laboratories conclusively prove that MAGLITE D provides better scorch protection in neoprene compounds than other reactive magnesium oxides on the market. Additionally, it occupies only about one-third the warehouse space as many of the lightweight, reactive magnesium oxides. You can always count on uniformity of chemical and physical characteristics, ease of dispersion, practical cure rates, and speedy delivery when you specify the MAGLITE brand. MAGLITE D is ideal for compounding neoprene and Hypalon. MAGLITE K, L, or M is particularly well-suited for other elastomers and for certain product or process requirements. Stocks of all MAGLITE products are quickly available from 15 strategically located warehouses.

For further information and samples—write MERCK & Co., Inc., Marine Magnesium Division, Dept. RW-4, Rahway, N. J.

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*reasons
why
permanently-
attached
couplings*

*mean
better
service,*

*bigger
profits!*

1 PERMANENTLY-ATTACHED HOSE COUPLINGS COST LESS than re-attachable couplings. Modern hose is of such good quality, lasts so long, by the time hose needs replacing so do re-attachable couplings.

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For fuel-oil hose . . . permanently-attached couplings by **SCOVILL**



For complete specifications on fuel-oil hose couplings write to Scovill Manufacturing Co., Merchandise Division, 88 Mill St., Waterbury 20, Conn. Ask for Bulletin No. 520-H.

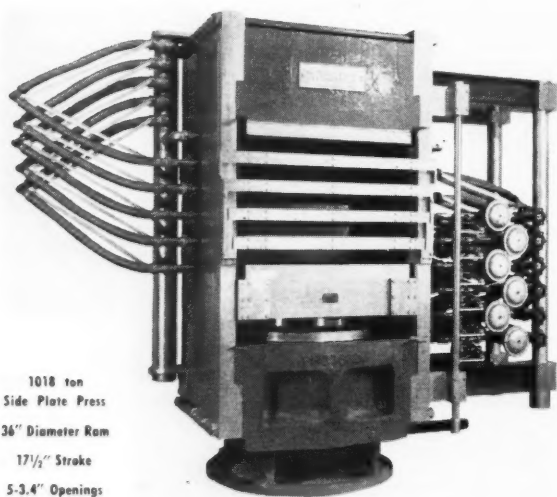
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1018 ton
Side Plate Press
36" Diameter Ram
17 1/2" Stroke
5-3.4" Openings
45" x 42"
Pressing Surface

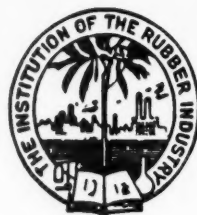
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Institution of the Rubber Industry LONDON

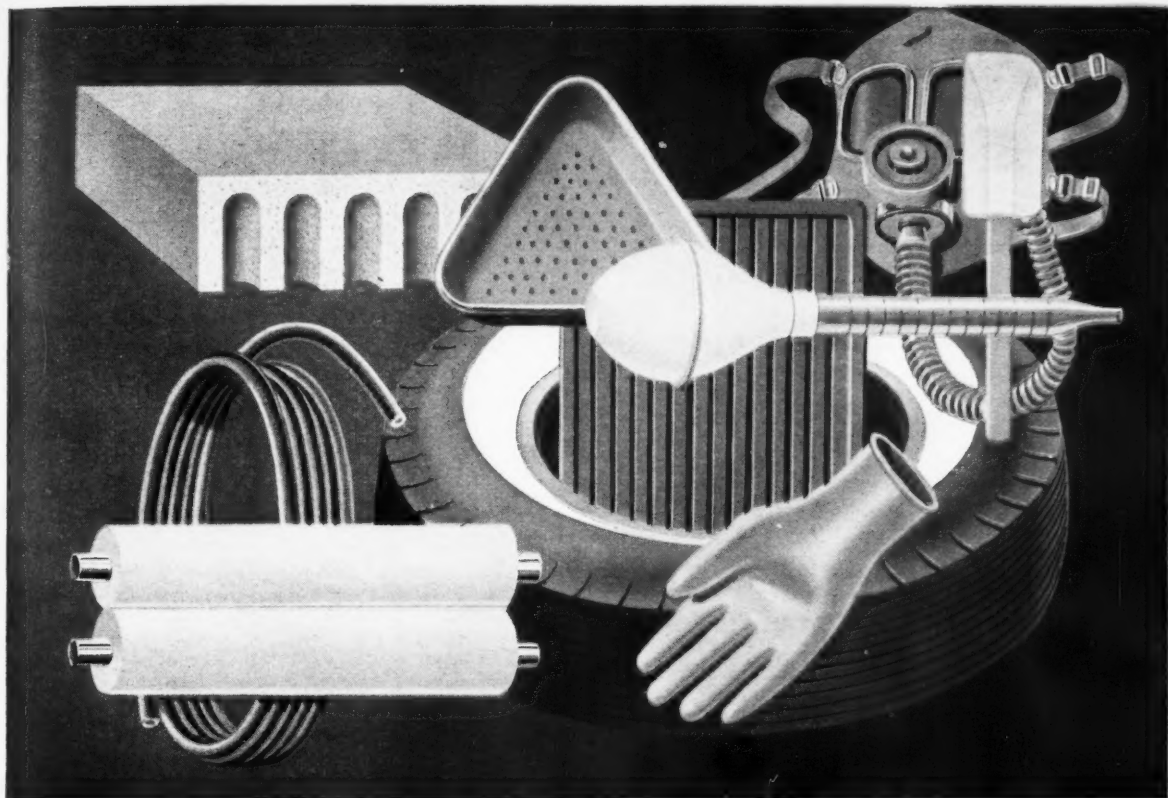
You are invited to become a member.

The annual subscription of \$7.50 brings to members the bi-monthly *TRANSACTIONS* and *PROCEEDINGS*, which contain many original papers and important articles of value to rubber scientists, technologists, and engineers.

Members have the privilege of purchasing at reduced rates other publications of the Institution, including the *ANNUAL REPORT ON THE PROGRESS OF RUBBER TECHNOLOGY* (which presents a convenient review of advances in rubber), and a series of *MONOGRAPHS* on special aspects of rubber technology (monographs published to date deal with Tire Design, Aging and Calendering).

*Further details are easily obtained
by writing to:*

**SECRETARY
INSTITUTION OF THE RUBBER INDUSTRY
4, KENSINGTON PALACE GARDENS
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Telephone: Bayswater 9101



You'll find Nevastain B is a superior non-staining antioxidant at lower cost

Nevastain B is an excellent non-staining, non-discoloring antioxidant developed especially for rubber manufacturers who prefer an antioxidant in the flaked form for greater convenience in compounding operations. It is shipped in sturdy 50-pound bags for easy weighing and handling. *In some instances, Nevastain B can replace products three times higher in cost,* and it has proved itself to be readily compatible with synthetic and natural rubbers, has shown no indication of blooming at more than double normal dosage,

and does not interfere with the rate of cure. Write for a sample and the Technical Service Report on Nevastain B.

Neville Chemical Company, Pittsburgh 25, Pa.

Resins—Coumarone-Indene, Heat Reactive, Phenol Modified Coumarone-Indene, Petroleum, Alkylated Phenol • **Oils**—Shingle Stain, Neutral, Plasticizing, Rubber Reclaiming • **Solvents**—2-50 W Hi-Flash, Wire Enamel Thinners, Nevsol.

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Please send Technical Service Report on Nevastain B.

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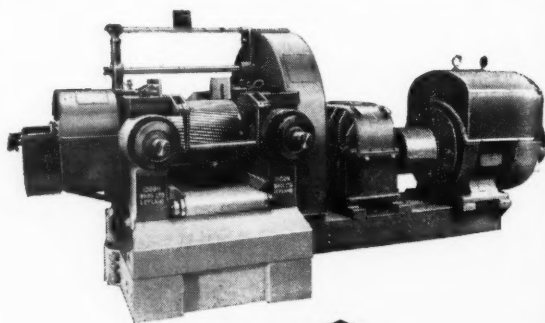
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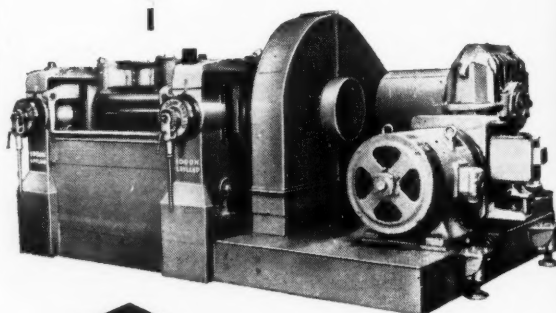
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C.A.6.

Heavy Duty Single Geared Cracker with Take-Off Conveyor. Machine mounted on fabricated sub-frame fitted with vibro-insulators. Rolls 20" dia.



B.Y.II.

Heavy Duty single Geared Mixing Mill with backshaft drive. Mounted on fabricated steel bed-plate fitted with vibro-insulators. Rolls 22" dia.

These two machines are designed to work together and breakdown the sliced Rubber to produce sheeted compounds for a variety of products. Production is increased with a minimum amount of labour.

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Maximum Benefit**

The problems eliminated by this unique reel-less core packaging system are manifold. Loads are palletized two cores per pallet and may be stacked two or three high. This, plus the fact that

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This is typical of Roebling's advanced packaging methods—that makes handling Roebling high-quality wire so

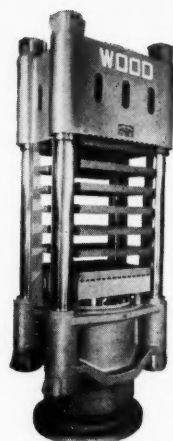
much easier. For details on this efficient Roebling Tire Bead Wire packaging method, or information on other types of Roebling wire, write Wire and Cold Rolled Steel Products Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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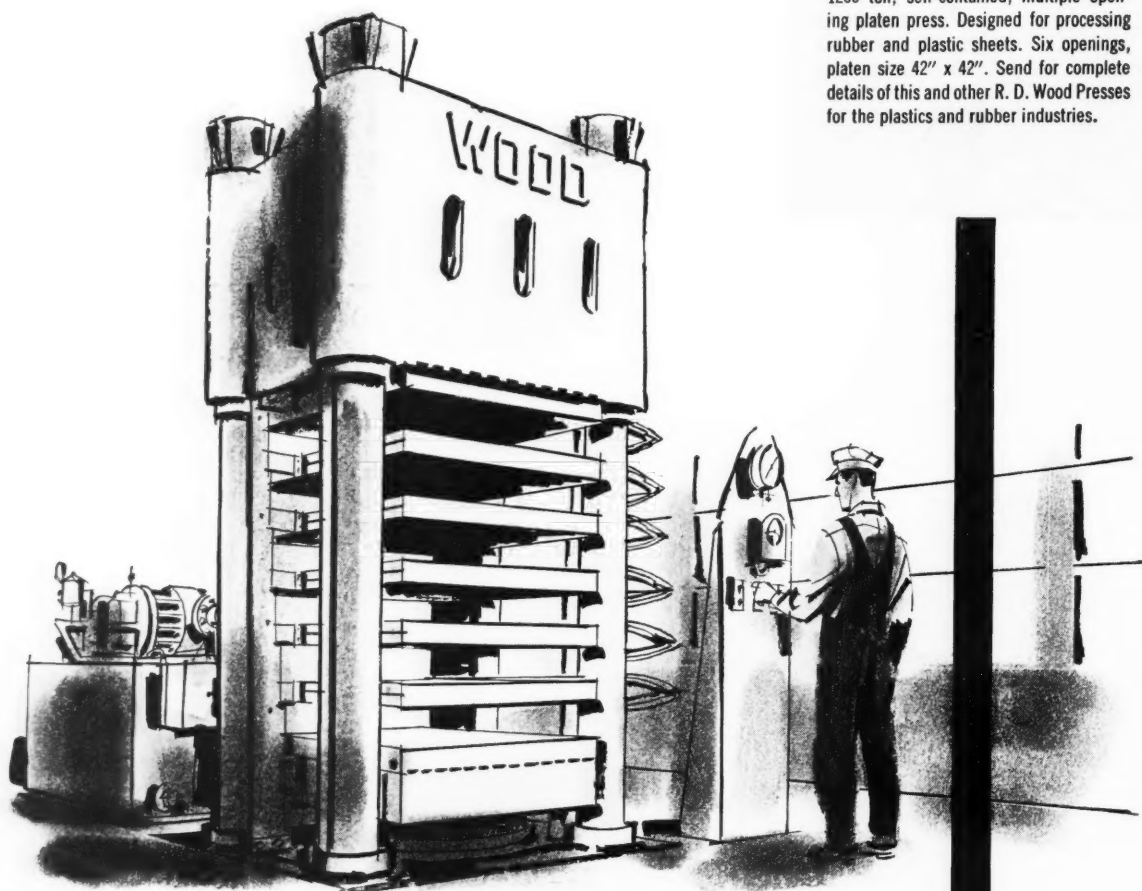


*There's always a job for a Wood Press . . .
and a Wood Press to do the job*

When you want a production shortcut—or downtime and costs need cutting—there's a job for a Wood Press. And in almost every type of plastics or rubber operation, there's a Wood Press to do the job. R. D. Wood builds presses for such jobs as molding, curing, laminating, polishing and processing—besides designing and constructing others for special work. All have three things in common: sound design, carefully selected materials, conscientious workmanship. As a result, R. D. Wood Presses consistently deliver the utmost in smooth, dependable performance; fast, economical production; trouble-free operation. Write for catalog and engineering information—without obligation.



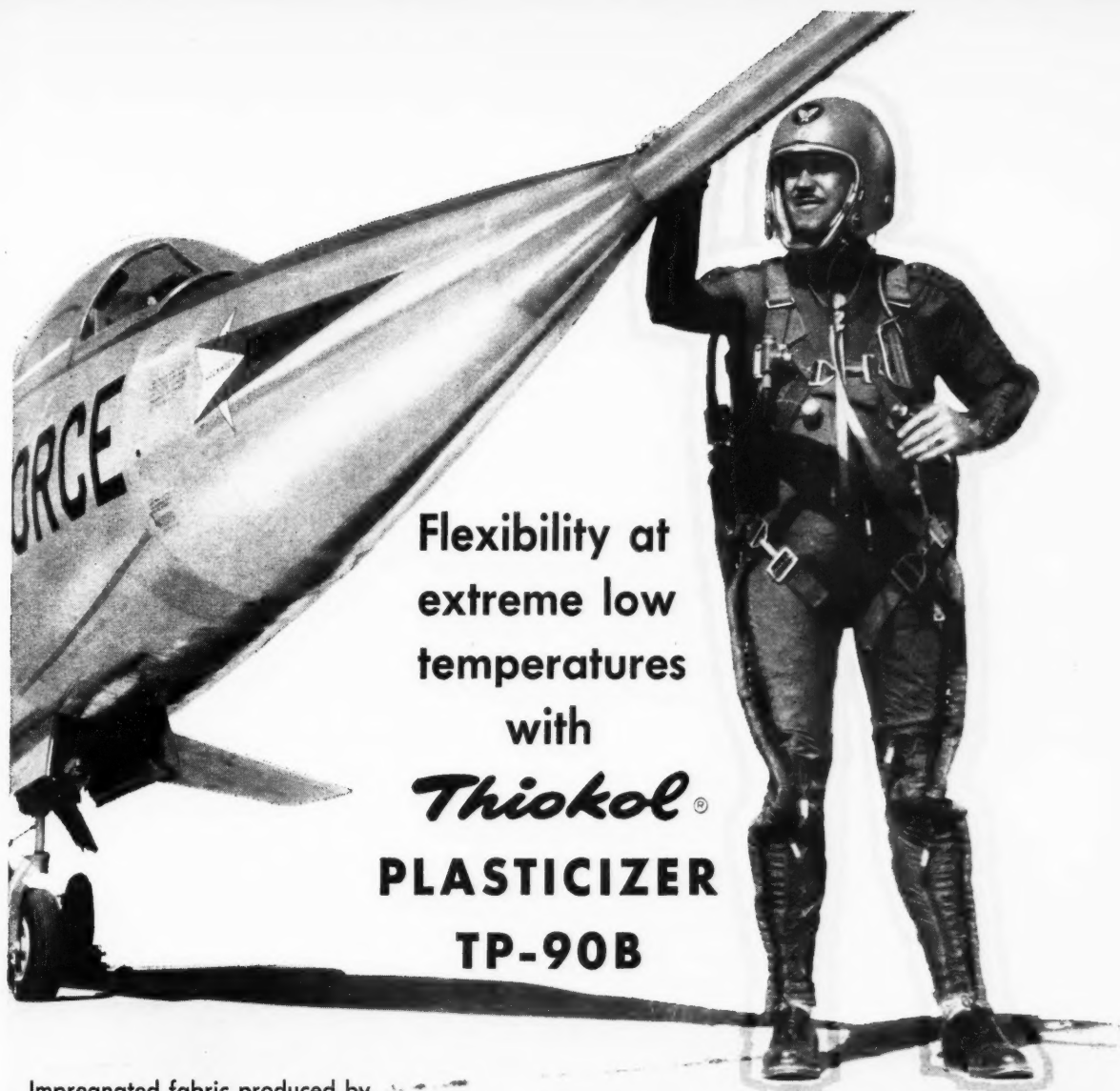
1200 ton, self-contained, multiple opening platen press. Designed for processing rubber and plastic sheets. Six openings, platen size 42" x 42". Send for complete details of this and other R. D. Wood Presses for the plastics and rubber industries.



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Flexibility at
extreme low
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with
Thiokol®
PLASTICIZER
TP-90B

Impregnated fabric produced by
Technical Rubber, Inc., West Haven, Connecticut

Dependable impregnated fabric flexibility at low temperatures is obtained by combining THIOKOL plasticizer TP-90B with synthetic rubber.

For example, in developing the new anti-G suit for supersonic travel, a fabric is required that can withstand tremendous pressures without air leakage. In addition, it must retain its flexibility at the extremely low temperatures of high altitudes. And, to avoid interference with aircraft operation, the anti-G suit fabric must be very light in weight.

A suitable fabric has been developed by coating nylon with many thin applications of a special Neoprene/THIOKOL plasticizer TP-90B compound. Aside from providing the necessary high pressure and low temperature properties,

THIOKOL plasticizer acts as an inhibitor against fungus which often causes fabric deterioration in tropical climates. •

• THIOKOL plasticizer TP-90B is also an ideal low temperature plasticizer for acrylonitrile rubbers, SBR rubber and natural rubber. It provides excellent low temperature properties and has low volatility.

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CHEMICAL CORPORATION

®Registered Trademark of Thiokol Chemical Corp. for its liquid polymers, synthetic rubbers, rocket propellants, plasticizers and other chemical products.

FOR MORE INFORMATION: Mail coupon to Dept. 12, Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton, N. J. In Canada: Naugatuck Chemicals Division, Dominion Rubber Co., Elmira, Ontario.

Gentlemen: Please send me further details about plasticizer TP-90B.

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Developed for you first by Monsanto

Five unusual chemicals ...what they can do

They're among the 85 Monsanto accelerators, antioxidants, plasticizers and specialty materials you can use for more efficient processing, better rubber goods. To help you meet specific needs, Monsanto draws from this chemical stockpile and the compounding know-how gained in 30 years of work with rubber processors.

SANTOFLEX® AW . . . antiozonant pioneer guards rubber against cracking caused by ozone attack.

Santoflex AW vaccinates styrene-butadiene rubber, as well as natural and nitrile rubbers, against ozone attack. Like the blooming type of waxes and other antiozonants, Santoflex AW is capable of slow migration to supply a continuous protective barrier. But unlike wax, which is often undesirable and ineffective because the wax film ruptures upon flexing, Santoflex AW retards flex cracking even under dynamic stress. It's the "standard" of the industry.



Santoflex AW protects stock under stress and exposed to 50 parts of ozone per 100 million parts of air for 48 hours.



Stock bloomed: 100 parts nitrile rubber, 5.0 zinc oxide, 1.0 stearic acid, 40.0 FEF black, 3.5 Thiurad.®



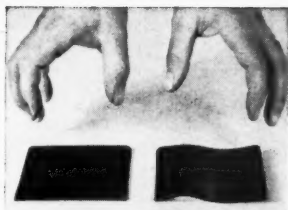
No bloom. Same stock except Thiurad reduced to 1.5 parts, and 1.5 parts of Sulfasan R added.

SULFASAN® R . . . non-discoloring vulcanizing agent—for part replacement of curing agents—makes possible bloom-free nitrile and butyl stocks with good physical properties.

When Sulfasan R is added in the range of 1 to 2 parts on the nitrile or butyl rubber (conventional vulcanizing agents are cut back, usually by the same amount as the Sulfasan R added), it imparts freedom from bloom, excellent aging and resistance to scorch. In butyl stocks, especially, it greatly improves resistance to compression set. And Sulfasan R is non-discoloring; it can be used in white and light-colored stocks.



You can feel the difference instantly. Stock at right, unmodified butyl. At left, modified with Elastopar.



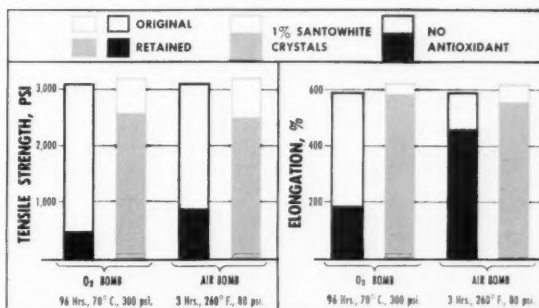
Sample modified by Elastopar, left, flattened completely in 3 seconds. Improved resilience is just one advantage.

ELASTOPAR®... chemical modifier puts springy life into butyl rubber—chemically—without heat treatment.

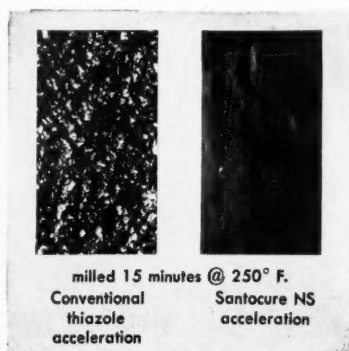
Here are eight other ways Elastopar improves the properties of butyl: vast increase in modulus—no increase in hardness—raises resistance to abrasion—lowers low-temperature flexibility—increases electrical resistivity in carbon black systems roughly from 10^6 to 10^{14} —reduces cold-flow of uncured stocks—lowers Mooney viscosity—does not affect cure.

SANTOWHITE® CRYSTALS... unique, bridged-phenol antioxidant protects light-colored rubber and latex.

Although rubber formulations perform differently, here is what you can obtain by adding 1 part per hundred parts of rubber: markedly less loss of tensile strength and elongation from heat exposure; improved retention of resilience over the service life of the compound; retarded stress decay. Most important, of course, is that Santowhite Crystals can be used in white and light-colored stocks based on both natural and most synthetic rubbers; it does not "dye" the compound; is nonstaining to lacquered and enameled surfaces that must contact the finished rubber part.



Results of air bomb and oxygen bomb tests show how effectively Santowhite Crystals protect the original properties of a natural rubber stock.



SANTOCURE® NS... powerful thiazole-type accelerator gives true delayed-action cures to insure rubber against scorch.

15-minutes milling at 250° F. was more than an ordinary thiazole accelerator could stand. It kicked off the cure too soon, causing scorch—often the cause of scrapped stock and defective end products. Santocure NS gives greater safety from scorch, with a true delayed-action cure. It works well in natural, reclaimed or synthetic rubbers. Furnace carbon blacks can be used for reinforcement—do not activate the curing system too greatly for use. Monsanto's Santocure was the first dependably successful delayed-action accelerator introduced for safer processing. Santocure NS has even better delayed action, and up to 10% less accelerator can be used. Properly compounded, the rubber has excellent heat resistance, good aging and low compression set.

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To be sure you're familiar with all the benefits of Monsanto chemicals and services—including dependable delivery schedules, improved handling characteristics, expert compounding counsel—talk over your compounding problems with your Monsanto representative. You'll also want a copy of *Monsanto Chemicals for the Rubber Industry*, a descriptive catalog for compounders. Just mail in the coupon or call Akron, HEMlock 4-1921.



MONSANTO CHEMICAL COMPANY

Rubber Chemicals Department

Akron 11, Ohio Telephone: HEMlock 4-1921

In Canada: Monsanto Canada, Ltd., Montreal

- ☐ Send catalog "Monsanto Chemicals for the Rubber Industry."
☐ Have representative call.

Name.....

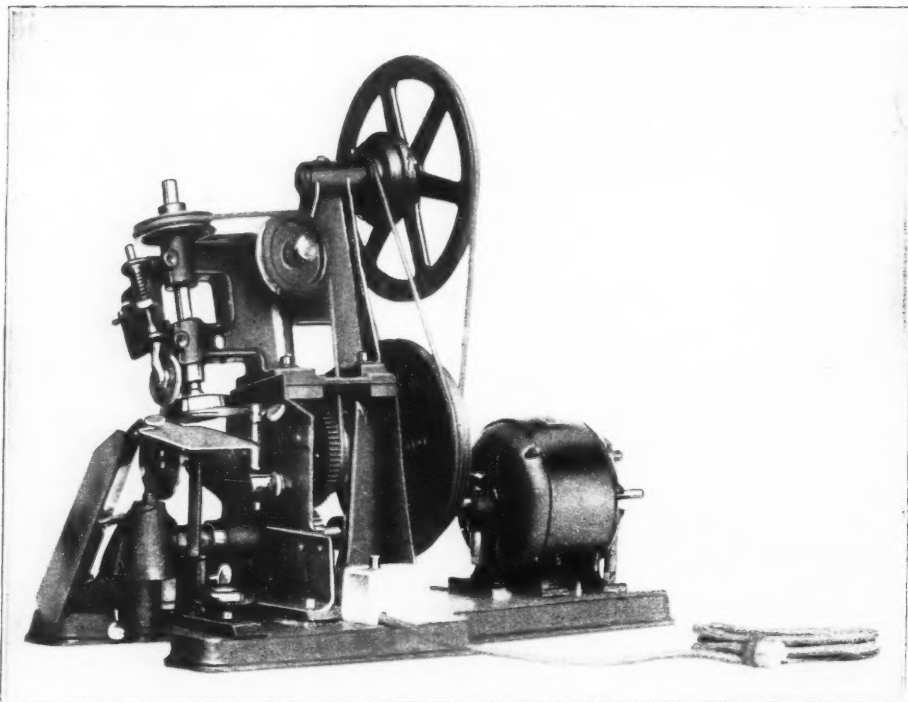
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The World's Trimmers



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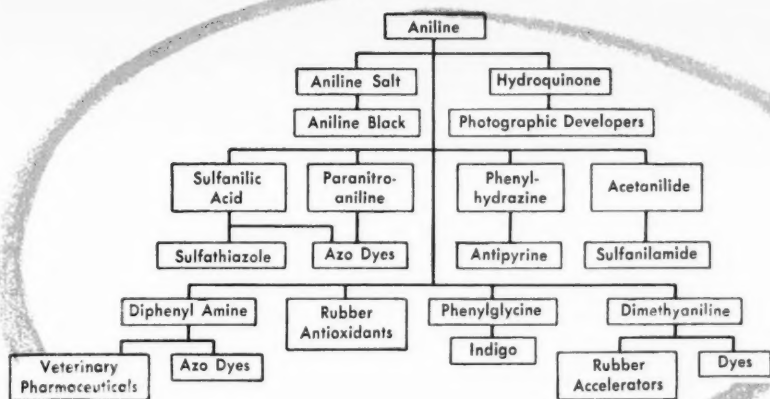
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"Fresh" We make, load and ship continuously to minimize the color degradation inherent in aniline.

Uniform Twin catalytic-hydrogenation units operating under National's unique process are controlled by automatic instrumentation. That means uniform, round the clock tonnage-output!

Fast Tank car, tank wagon shipments from Moundsville, W. Va. on 24-hour notice. Minimizes your inventory.

You pay no premium for National six-ways-good Aniline. Why not get our quotation?



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Here are three significant conclusions an advertiser may safely draw from this performance record:

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- 2** The Bill Brothers Publications do a better than average job of serving these needs, editorially.
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If you are with one of those companies which are busily cutting expenses in preparation for a severe recession, or with an agency having trouble with client pessimism, we recommend to you a recent talk made by the publisher of **SALES MANAGEMENT**, Phil Salisbury, before the Eastern t.f. Club. It does a better demolition job on the prophets of doom and the exponents of gloom than anything we've seen in some time. (Sample: "Never have I known of a company that was able to economize itself into a profit.") Phil's talk has been reprinted into a booklet entitled "Business is what you make it." Copies of it are available from *Bill Brothers Publications*.



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IS WHAT
YOU
MAKE IT**

Bill Brothers Publications

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in Industry

**Plastics Technology
Rubber World**

in Marketing

**Premium Practice
Sales Management
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Tide**

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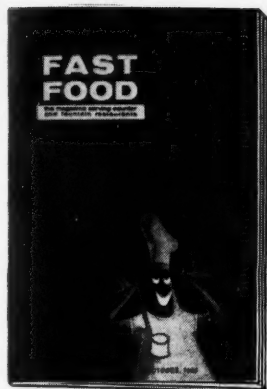
**Fast Food
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Tires TBA-
Merchandising**

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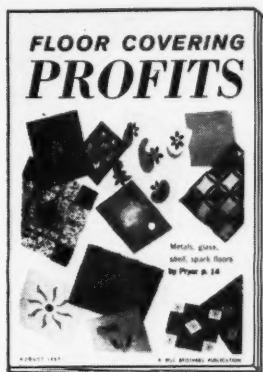


PUBLICATIONS

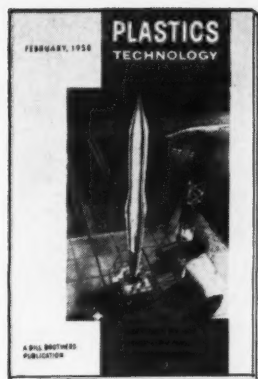
*Each Bill Brothers
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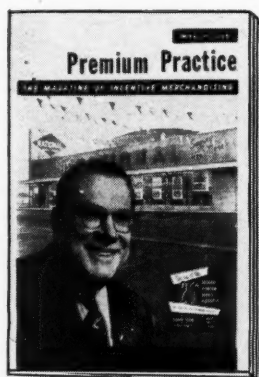
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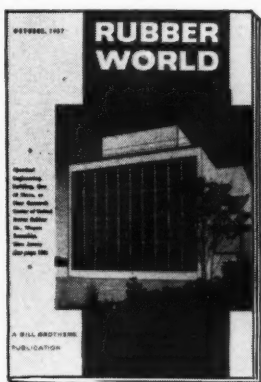
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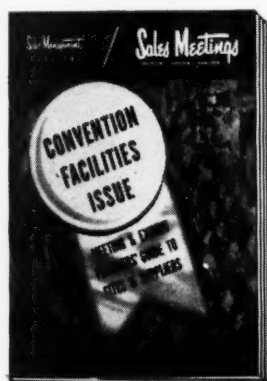
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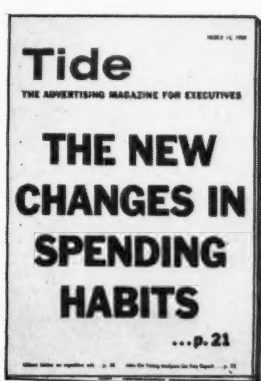
RUBBER WORLD — Serves the rubber industry; the technical production executives among the manufacturers of tires, tubes, mechanical rubber goods, footwear, reclaimed rubber, plastics, chemicals, machinery, equipment, and synthetic rubber products.



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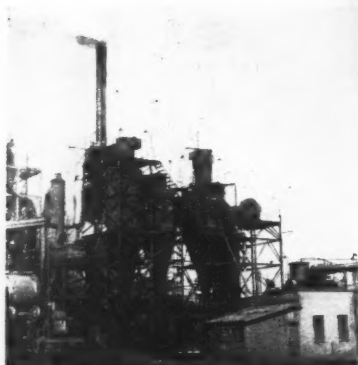
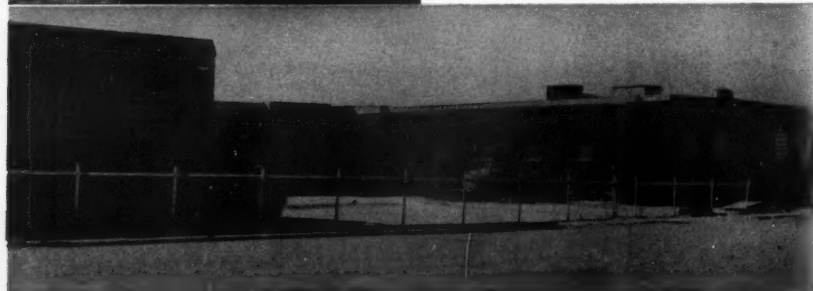
TIDE — The Advertising Magazine for Executives, serves a broad management group with its new interest in advertising, as well as those executives with line responsibility in advertising.



TIRES TBA-MERCHANDISING — The merchandising publication serving independent tire dealers-retreaders, automotive wholesalers of tires, batteries and accessories and independent oil jobbers with TBA programs.



Borger Laboratories are equipped with science's latest tools for rubber research.



Carbon black research also takes place in this Borger pilot plant.

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for compounding problems of every type

During the forty years we have been making carbon blacks, our Research Laboratories have made many significant contributions to rubber technology. Staffed by experts, equipped with modern facilities, and backed by long experience, our laboratories are ready to assist in any of your compounding problems.

In addition to the broad areas of carbon black improvement and utilization, our Development Department is constantly occupied with solving specific compounding problems. The continued use of our facilities attests to the high standards of the laboratories and the Technical Reports and Data Sheets they publish.

The full facilities of our Research Department are available through your nearest Huber representative. He is a trained rubber technologist and will see that your compounding problems are sent to proper channels at our Borger, Texas headquarters.



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Wise Owls  read Huber Technical Data. Ask to be put on our mailing list.

Centralized Agency Needed For Foreign Technical Information

THE evidence is accumulating that the reason the United States underestimated the extent of recent Russian progress in science and technology is that we did not have a sufficiently well organized and adequate means of determining this progress. Although Russian literature was not very freely available in this country until 1955, that which was available was not too well publicized.

In January, Secretary of Commerce Sinclair Weeks announced that as a result of a survey made with the National Science Foundation, a plan to establish a Foreign Technical Information Center within the Department of Commerce had been developed. A special appropriation of \$300,000 was requested of Congress to initiate the program. The President's budget for 1959 includes a request for \$1.25 million for the Foreign Technical Information program, but it was felt that advent of the Russian Sputniks required more prompt action on the program.

In recent years, government agencies and private institutions and industries have steadily increased their translation of Soviet literature, but *there is no central agency in government responsible for acting as a central clearing house on all such information, and the need is becoming more and more self evident.*

Unfortunately, Congress does not seem to have the same sense of urgency today as it had a few months ago, and the \$300,000 special appropriation request was rejected, and the Commerce Department was told to give further study to this proposal in view of the fact that other federal and private agencies are already doing work in this field.

There are many reasons why such a central clearing house of foreign technical information should be established to serve all branches of science and

technology, including rubber. The All Union Institute of Scientific & Technical Information was created in Russia in 1952 and employs about 2,000 permanent staff members and uses another 20,000 scientists and engineers as part-time translators and abstractors, according to the "Industrial Bulletin" of Arthur D. Little, Inc., for February. Abstracts from articles appearing in 12,000 journals originating in 85 countries outside USSR are prepared and circulated promptly to key Soviet industries and scientists within a matter of weeks.

The rubber industry in this country is apparently dependent on commercial translating services for its information on advances in rubber in Russia. This is also true of *Rubber Chemistry and Technology*, the publication of the Division of Rubber Chemistry of the American Chemical Society. Although a commendable effort has been made to make as many translations available as possible, there is undoubtedly room for improvement.

All industry, technology, and science would seem to have a stake in this Commerce Department effort to establish a central clearing house for foreign technical information, particularly for that originating in Russia at the present time. The new Center would operate a coordination service to eliminate duplication of translating among U. S. and private agencies and friendly foreign governments. *The program appears to be one which should merit the support of management in the rubber and associated industries.*

R. G. Seaman

EDITOR

Thiate^{*} accelerators for Neoprene Vulcanization



scorch rate . . . *Slow*

stock
storage problem . . . *No*

production rate . . . *Go!*

Thiate A is recommended for Neoprene Type W and GN compounds designed for open steam and press cures.

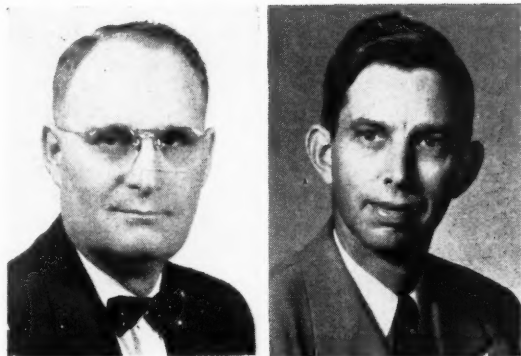
Thiate B is most effective in Neoprene stocks designed for press cures particularly where low compression set is required.

*registered U.S. trademark

R. T. Vanderbilt Co., INC.

230 Park Avenue, New York 17, N.Y.

Low-Temperature Properties of 80% Cis-Polybutadiene¹



H. E. Railsback

Q. L. Morris

The Authors

H. E. Railsback, manager research compounding section, synthetic rubber branch, Phillips Petroleum Co., received his B.S. degree from Peru State College in Nebraska in 1936. He did graduate work at the University of Nebraska in 1937 and at Peru State College in 1939.

Mr. Railsback taught from 1936 to 1941. He joined E. I. du Pont de Nemours & Co., Inc., in 1941 and remained with Du Pont until 1945, when he entered the research division of Phillips Petroleum Co. He has been manager of the research compounding section since 1955.

This author is a member of the American Chemical Society and its Rubber Division and the Southern Rubber Group.

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Dr. Morris was an associate professor of chemistry at East Texas State College from 1951 to 1953, held a similar position at Northwestern State College in Louisiana in 1953-54, returned to East Texas State College in 1954-56, and was with Phillips Petroleum Co. as a research chemist in 1956-57. He is now associate professor of chemistry at Northwestern State College.

Dr. Morris is a member of the American Chemical Society, Sigma Xi, Phi Lambda Epsilon, and Texas State Teachers Association.

By H. E. RAILSBACK and Q. L. MORRIS²

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A PREVIOUS paper³ has reported the preparation of 1,4-polybutadienes of variable *cis-trans* ratio ranging from 95% *cis* to nearly 100% *trans* configuration. Several rubbers of this type have been studied in conventional recipes. It was noted that a polymer of intermediate *cis* content, in the region of 80% *cis*, 15% *trans*, and 5% vinyl configuration, displayed an unusually low freeze point, with no indication of crystallization (first-order transition).

It is known that laboratory tests do not necessarily permit reliable predictions of the service performance of elastomeric compounds in Arctic service (ASTM D 832-56T).⁴ Nevertheless it was considered advisable to study polymers of this type more extensively to determine if significantly different first- and second-order transition points would be obtained, using tests designed specifically to induce crystallization.

The rubber selected for this work contained 78.6% *cis*, 16.6% *trans*, and 4.8% vinyl unsaturation and had a Mooney viscosity (ML-4 at 212° F.) of 18.

Experimental Details

SBR 1500, emulsion polybutadiene with a Mooney viscosity of 29, and #1 Ribbed Smoked Sheet natural rubber were chosen for comparison. The basic compounding recipes used are shown in Table 1.

In addition to the usual tests, the physical properties of these stocks were studied at various temperatures to —115° C. The freeze point was determined by use of the Gehman torsion apparatus (ASTM D 1053-54T).

The rate of retraction of extended strips of the rubber stocks was measured after conditioning at the selected temperatures for 22 to 70 hours. The strips were ex-

¹Presented before the Division of Rubber Chemistry, ACS, New York, N. Y., Sept. 13, 1957.

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³*Rubber and Plastics Age*, 38, 10, 880 (1957).

⁴American Society for Testing Materials, Philadelphia, Pa.

TABLE 1. BASIC COMPOUNDING RECIPES

	80% <i>Cis</i> - Polybu- tadiene	Emulsion Polybu- tadiene ^a	SBR 1500 ^b	Natural Rubber
Rubber	100	100	100	100
HAF black (Phil- black O)	50	50	50	50
Zinc oxide	3	3	3	4
Stearic acid	2	1	1	3
Flexamine ^c	1	1	1	1
Resin 731 ^d	3	—	—	—
Philrich 5 oil ^e	5	5	—	—
Circo-Para ^f	—	—	10	—
Pine tar	—	—	—	3
Sulfur	2	1.75	1.75	2
Santocure ^g	1.25	1.5	1.1	0.5

^a41° F., rosin acid emulsified, 60% conversion, 29 Mooney viscosity polybutadiene.

^b41° F., rosin acid emulsified, 60% conversion, 52 Mooney viscosity, 28/72 styrene-butadiene rubber.

^c65% diarylamine-ketone reaction product and 35% N, N'-diphenyl-p-phenylene-diamine antioxidant, Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

^dDisproportionated pale resin, Hercules Powder Co., Wilmington, Del.

^eAromatic petroleum oil, Phillips Chemical Co., Akron, O.

^fA 1:1 ratio blend of Circosol 2XH (Sun Oil Co., Philadelphia, Pa.) and Paraflux 2016 (C. P. Hall Co., Akron).

^gN-cyclohexyl-2-benzothiazole sulfenamide, Monsanto Chemical Co., Rubber Chemicals Department, Akron.

NOTE: All compounds cured at 307° F.

General Physical Properties

The physical properties usually determined for tread compounds show trends for the 80% *cis* polymer similar to those previously observed for polybutadienes having a *cis* content in this range. Moderate tensile strength and good hysteresis properties were displayed by this rubber.

These data are shown in Table 2. Cross-link density was determined as described by Kraus.⁵ Heat build-up, (T° F.), equals rise in temperature above 100° F. oven temperature in Goodrich flexometer after 15 minutes. Flex life was determined using a modified ASTM D 813-52T DeMattia test (three-inch-wide test specimen, three-inch stroke at 210° F.). The data are reported as thousands of flexures to complete break. The low Mooney viscosity polymer investigated handled nicely on the mill, and the black dispersion was good.

Second-Order Transition (Vitrification)

It has been reported⁶ that the second-order transition temperature or glassy state temperature, as experimentally determined, is somewhat time dependent. For most polymers, however, the change occurs quickly within a definite temperature range of a few degrees (ASTM D 832-56T). Several methods have been developed for determination of this transition point in-

TABLE 2. PHYSICAL PROPERTIES OF STOCKS CURED 30 MINUTES AT 307° F.

Elastomer	$\nu \times 10^{18}$ Moles/ Cc.	Compres- sion Set	300% Modulus, Psi.	Tensile Strength, Psi.	Elong- ation, %	Heat Build-Up, ° F.	Resil- ience @ 80° F., %	Shore Hard- ness	Flex Life, M
80% <i>Cis</i> -polybutadiene	1.72	13.8	1500	2025	380	43.9	72.6	67	3.4
Emulsion polybutadiene	1.48	15.6	2060	2550	345	54.7	63.9	65	2.5
SBR 1500	1.37	18.7	1500	3080	495	53.0	63.3	63.5	19.5
±1 RSS	1.25	19.4	1625	3075	450	42.2	69.6	64	110.0 ^g

^aCross-link density as determined by swelling techniques.

^g% broken at 50,000 flexures.

tended to 50% or 250% elongation in the racks designed for the ASTM "T-50 test." After conditioning in the cold cabinet, the specimens were released, and the % retraction was read at intervals to a total time of 30 minutes.

Compression set (ASTM D 1229-55) was measured at temperatures ranging from -37 to -65° C. The pellets were compressed to 0.325-inch (approximately 30% compression) at room temperature. After conditioning at the selected temperature for 22 or 70 hours, the pellets were removed from the jigs and measured at 10 seconds and at 30 minutes.

Resilience of the stocks was determined at temperatures from 100 to -70° C., by use of a Yerzley oscillograph (ASTM D 945-55).

Shore A hardness was determined on stocks conditioned at temperatures ranging from 26 to -55° C. The stocks were conditioned for one hour or 70 hours at the test temperature.

¹RUBBER WORLD, 135, 1, 67; 135, 2, 254 (1956).

²Alfrey, Goldfinger, Mark, *J. Applied Phys.*, 14, 700 (1943).

³Henderson and McLeod, *Trans. Inst. Rubber Ind.*, 30, 5, 115 (1945).

cluding a study of volume-temperature relations.⁷

GEHMAN FREEZE POINT. The freeze point is considered to be reliably predicted by use of the Gehman apparatus. In this laboratory the straight-line portion of a plot of the angular twist *versus* temperature is extrapolated to the temperature axis. The point of intersection of this straight-line portion with the temperature axis is considered to approximate the freeze point.

Figure 1 shows the freeze point of the *cis*-polybutadiene, as determined by the Gehman method, to be -97° C. (-143° F.). This freeze point is 45° C. (81° F.) below that of SBR 1500 which froze at -52° C. (-62° F.). A freeze point of -61° C. (-78° F.) was obtained for the natural rubber stock. The emulsion polybutadiene stock crystallized.

First-Order Transition

According to ASTM D 832-56T, the most reliable means of determining if first-order transition (crystallization) occurs requires that the vulcanizates either be elongated or compressed.

Low-Temperature Properties of 80% Cis-Polybutadiene

Polybutadiene rubbers have been found to display excellent freeze resistance when the *cis* configuration is in the range of 80%. The outstanding freeze resistance observed for such rubbers (Gehman freeze points as low as $-100^{\circ}\text{C}.$) made a comprehensive study of the low-temperature characteristics of rubber of this type mandatory although it was realized that reliable predictions of Arctic service performance from laboratory tests would be difficult. Particular attention was given, therefore, to tests designed to give the most reliable indication of both first- and second-order transition.

The rubber selected for study had a Mooney viscosity (ML-4 at $212^{\circ}\text{F}.$) of 18. The configuration was 78.6% *cis*, 16.6% *trans*, and 4.8% vinyl. Tests performed included Gehman freeze point, rate of retraction, cold compression set,

resilience and Shore hardness; properties were determined at test temperatures as low as $-115^{\circ}\text{C}.$ and conditioning times up to 70 hours.

The 80% *cis* polymer gave a Gehman freeze point of $-97^{\circ}\text{C}.$ (SBR 1500, $-52^{\circ}\text{C}.$; natural rubber, $-61^{\circ}\text{C}.$) and less tendency to crystallize (first-order transition) than natural rubber or emulsion polybutadiene, under the conditions used. The 80% *cis* rubber gave much softer and more elastic stocks at low temperature than did any of the controls. Polybutadiene of this structural configuration displays stress-strain properties similar to those of emulsion polymerized polybutadiene and hysteresis properties equivalent to those of natural rubber. Although not now commercially available, this type polymer should prove to be useful in general applications and to be outstanding for low-temperature service.

Mooney and Wolstenholme⁸ have observed a relaxation of stress in twisted cylindrical samples of vulcanized rubber at low temperature. This phenomena was attributed to progressive alignment of chain segments in a crystalline pattern under the orienting influence of the deformation. First-order transition is also more likely to occur if long conditioning times are employed.

RATE OF RETRACTION. Curves are shown in Figure 2 for retraction of strips which were extended to 50% elongation and conditioned at the selected temperatures for 22 hours before releasing. Figure 3 presents data for specimens having identical treatment except that they were conditioned for 70 hours prior to their release. Curves for 80% *cis*-polybutadiene and natural rubber only are shown at $-60^{\circ}\text{C}.$ since the other rubbers were frozen at $-50^{\circ}\text{C}.$ In all cases the 80% *cis* rubber was more elastic than any of the controls. It will be noticed that the curve for natural rubber at $-37^{\circ}\text{C}.$ for 70 hours shows less retraction under these conditions than at lower temperature or shorter time, which indicates more crystallization at this temperature.

The rate of retraction at a constant temperature was determined rather than "TR values" (ASTM D 1329-54T), in order that the extended specimen might have time to crystallize if there was a tendency to do so.

Since the degree of elongation would have an effect on the orientation of the molecules and possibly on the crystallization of the stocks, the rates of retraction of one series of specimens were determined after conditioning at 250% elongation for 22 hours. The data are presented in Figure 4. Increasing the elongation changed the rate of retraction of the 80% *cis* rubber only slightly. The effect on some of the control stocks was very pronounced. At each temperature the natural rubber displayed less retraction after high elongation than it did after conditioning at 50% elongation for the

same time, indicating more crystallization at the greater elongation. The curves for the 80% *cis* polymer were well above those of the controls in all cases.

To provide a better comparison of the effect of temperature and elongation on the rate of retraction, the 20-minute reading was taken from each retraction *versus* time curve, and these values were plotted against temperature. The isopleths in Figures 5 and 6 show that the 80% *cis* rubber is more elastic than the controls in all cases. While the % retraction was small for all rubbers at $-60^{\circ}\text{C}.$, at any temperature above this the curve for 80% *cis*-polybutadiene is well above the curves for the other rubbers. In contrast to the curves for the other rubbers, the change of the slope of the curve for the 80% *cis* rubber is negative, indicating a greater range of temperatures at which this rubber will possess appreciable values of retraction. Greater differences in the retraction were observed when a longer conditioning period or a greater elongation was used.

It is interesting to note that the curves for natural rubber show maximum values for retraction at approximately $-45^{\circ}\text{C}.$ when the rubber is extended to 50% elongation; while no maximum is shown when the specimens are extended to 250% elongation. Crystallization at the higher temperature and elongation⁹ were responsible for this result. The rate of crystallization is at a maximum at $-26^{\circ}\text{C}.$ for natural rubber.¹⁰ At 250% elongation, however, this rubber crystallized in every case.

The emulsion polybutadiene displayed little elasticity at any temperature below $-35^{\circ}\text{C}.$

LOW-TEMPERATURE COMPRESSION SET. Tempera-

⁸Ind. Eng. Chem., 44, 335 (1952).

⁹Wood, "Advances in Colloid Science," Vol. II, p. 57. Interscience Publishers, Inc., New York (1946).

¹⁰Russell, Trans. Faraday Soc., 47, 539 (1951).

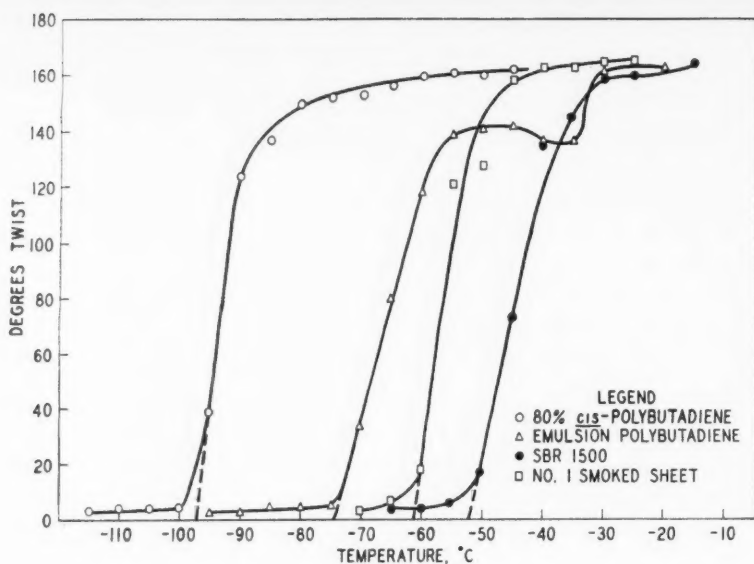


Fig. 2. Rate of retraction after 50% elongation for 22 hours at various temperatures

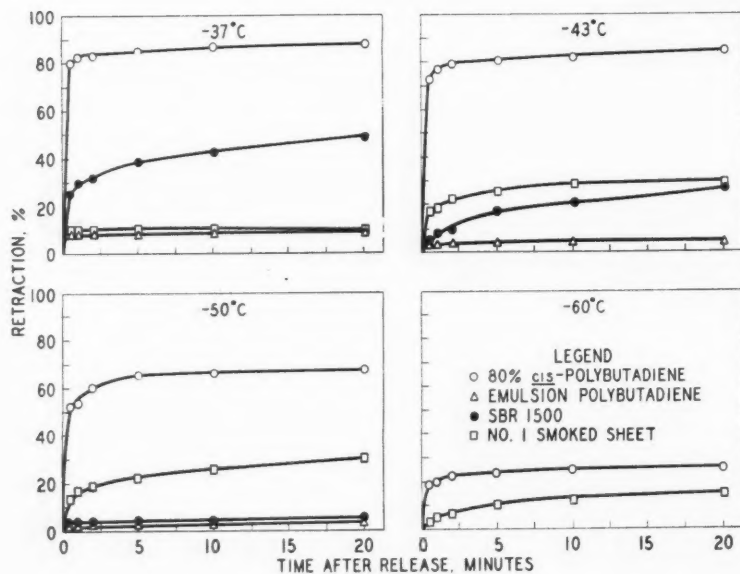
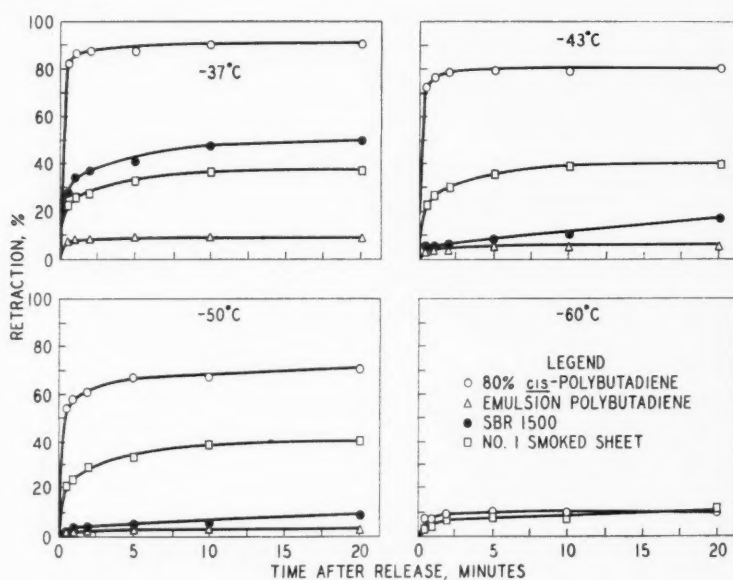


Fig. 3. Rate of retraction after 50% elongation for 70 hours at various temperatures



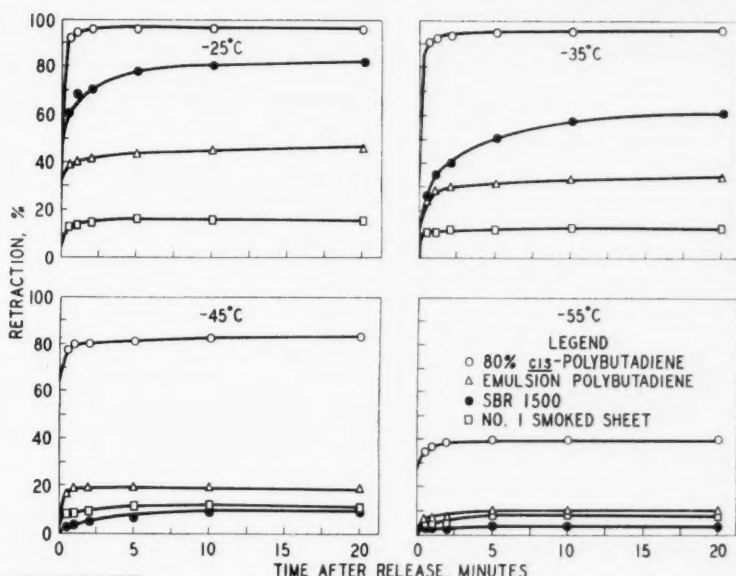
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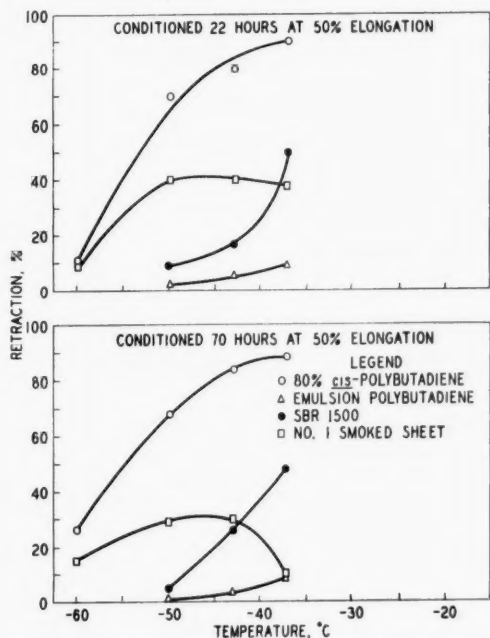
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Fig. 4. Rate of retraction after 250% elongation for 22 hours at various temperatures



(Below)
Fig. 5 Retraction vs. temperature—20 minutes after release; 22 and 70 hours' conditioning at 50% elongation



ture versus compression set curves are shown in Figure 7. The reproducibility of these data was not so good as for the other relations, but definite trends were established. While the actual freeze point was not determined by cold compression set, this fact gave another indication that the 80% *cis*-polybutadiene was pliable at temperatures several degrees below that at which controls were completely frozen.

The cold compression set and the rate of retraction were in effect measures of the same property. When the recovery of the compression set pellet at 30 minutes was compared to the % retraction at 20 minutes, good correlation was observed.

Simple Temperature (Viscoelastic) Effects

SHORE HARDNESS. The curves in Figure 8, relating

Shore hardness to temperature, show that the *cis*-polybutadiene became only slightly harder as the temperature was reduced to -55°C . At temperatures below -25°C , the curves for the other rubbers have a much greater slope, showing a large increase in hardness as the temperature was decreased below this point. The slope of the curve for the 80% *cis* polymer appears to be essentially constant over the entire range of temperatures used. Conditioning for the longer period of time before taking the measurements appeared to make little difference in most cases. The emulsion polybutadiene was slightly harder after conditioning for the longer period.

RESILIENCE. The 80% *cis*-polybutadiene displayed much better resilience at low temperatures than did the controls. Although the values were similar for all of the polymers at or above room temperature and at -70°C , the resilience of the controls decreased rapidly as the temperature was decreased, approaching a value of zero before increasing again. The resilience of the 80% *cis* polymer decreased slowly as the temperature was lowered, giving much better resilience than any of the controls in the range 0 to

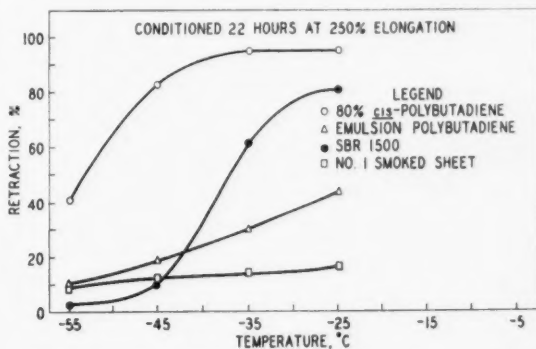


Fig. 6. Retraction vs. temperature—20 minutes after release; conditioned 22 hours at 250% elongation

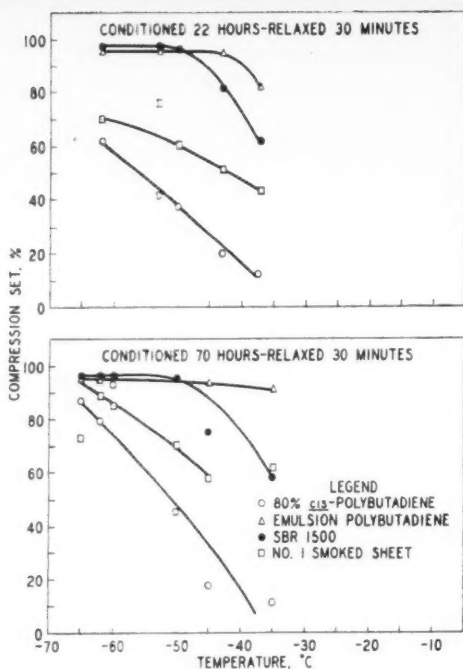


Fig. 7. Low-temperature compression set; conditioned 22 and 70 hours—relaxed 30 minutes

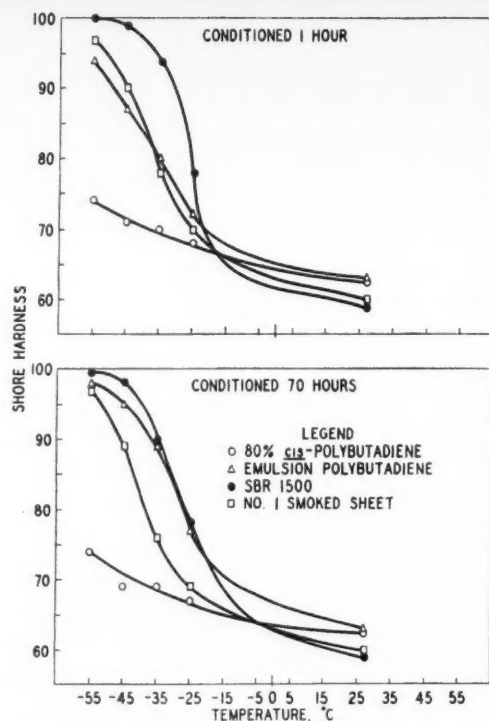


Fig. 8. Shore A hardness vs. temperature; conditioned one hour and 70 hours

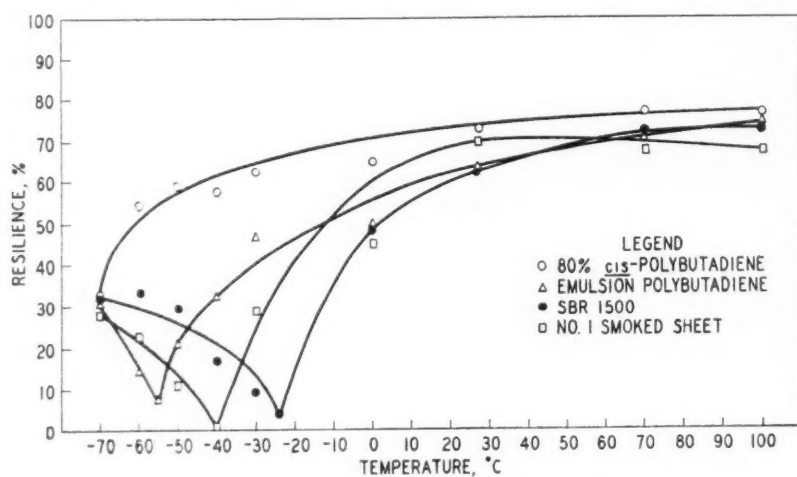
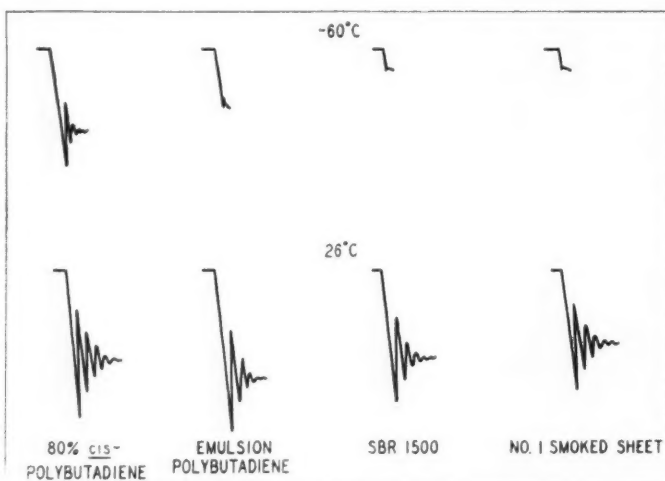


Fig. 9. Resilience vs. temperature

(Right)
Fig. 10. Resilience oscillograms



(This article is concluded on page 84)

Du Pont LCM Continuous Curing Of Neoprene Extrusions

A novel method for continuously curing neoprene extrusions either solid or sponge, has been developed by the elastomer chemicals department of E. I. du Pont de Nemours & Co., Inc.

The method employs a liquid curing medium (LCM) of either molten metal or oil maintained at an extremely high temperature, and relatively

complicated cross-sections have been successfully cured in 20 seconds.

The advantages cited are lower production costs, lower capital investment, and the retention of the smooth, glossy surfaces obtained at the extruder with oxidative surface degradation minimized by curing in the liquid medium.

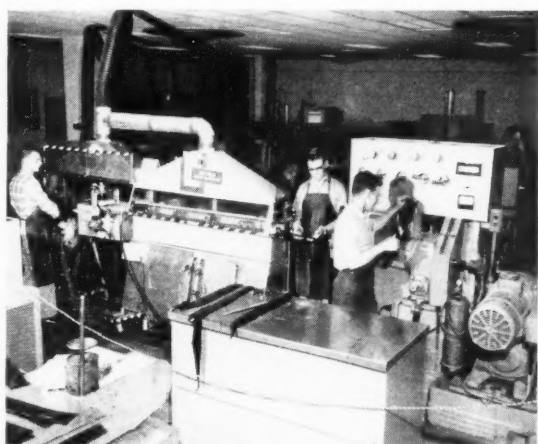


Fig. 1. LCM continuous curing of neoprene extrusions in the Du Pont laboratory. Extruder on right; LCM bath in center; cleaning bath and wind-up on left

THE economic advantages of continuously curing elastomeric extrusions have been recognized for a great many years, but relatively few methods have been commercially successful. The wire and cable industry has used a continuous vulcanization (CV) method successfully for several years, in which the coated wire is passed directly from the extruder through a long vulcanizer containing high-pressure steam. Other processes involving hot air tunnels, radiant heaters, or dielectric units have been used commercially to a limited extent.

The new method developed in the laboratory of the elastomer chemicals department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., employs a liquid curing medium (LCM) which may be either a molten metal or organic or inorganic liquid, maintained at a temperature of 400° to 600° F. The heat transfer with the liquid media is very rapid, approximately six times as fast as in air, allowing curing times of less than 30 seconds. A production extrusion rate of 40 feet per minute could therefore be attained with a curing tank 20 feet in length.

The idea of curing continuously in hot liquids is not

new. Patents disclosing processes of this type date back as far as 1915, but for various reasons these processes have seen little commercial use. Probably the biggest road block has been the problem of porosity in solid extrusions. The solution of this problem by proper compounding and extrusion techniques has opened the door for broad utilization of the LCM method. Although the limitations of the method have not been fully explored, relatively complicated cross-sections of neoprene extrusions have been successfully cured on laboratory equipment. Figure 1 shows equipment in operation in the Du Pont elastomer chemicals laboratory. The LCM material in this case is oil.

The advantages of the LCM extrusion method are lower production costs due to reduced labor requirements, shorter processing time, lower capital investment required for this type of equipment, and lower scrap losses. Other advantages are that the smooth, glossy surfaces obtained at the extruder can be retained after cure, and, since oxygen is excluded from the surface of the section being heated in the liquid, oxidative surface degradation is minimized.

Equipment Requirements

Equipment requirements vary somewhat, depending on whether the LCM is molten metal or oil. In the first case a means of coating the outside uncured surface of the extrusion with talc or other materials before it enters the curing medium may be required, and in the second case the cooling tank adjacent to the curing medium contains a detergent to remove oil from the cured extrusion. Figure 2 is a schematic drawing of the system with both a precoat and a cleaning tank.

Long-length, positive feed extruders are helpful in reducing porosity and for thoroughly blending the stock prior to extrusion. The No. 1 Royle¹ extruder which has been used in laboratory experiments has a double-barrel extension with a total barrel length three times as long as a standard rubber extruder. The length to diameter ratio of the screw is 10.5. While stocks with a cured Shore A hardness in the range of 50 have been extruded without porosity, L D ratios of 16 or higher are desirable.

¹ John Royle & Sons, Paterson, N. J.

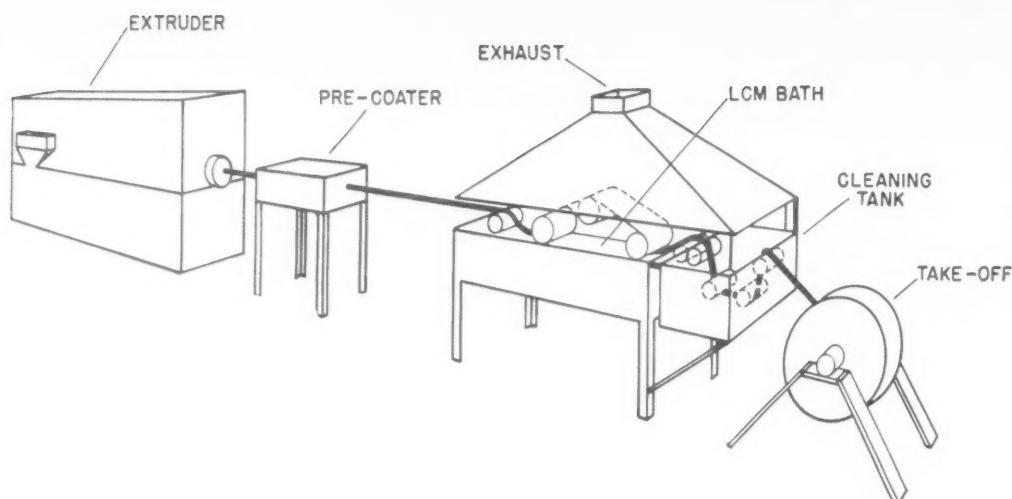


Fig. 2. Schematic diagram of LCM continuous curing extrusion process showing precoater, LCM bath, cleaning tank, and wind-up or take-off

Best results have been obtained with a type of screw used in the plastics industry (compression obtained by increasing the root diameter toward the discharge end) containing a distinct metering section, gradual compression section, and feed section. The use of a screen pack and breaker plate which effectively increases the extruder pressures has been found desirable when a conventional rubber screw is used.

Vacuum extruders² can be designed to provide vacuum through the barrel wall or through the screw, and the relatively new technique for minimizing porosity involved here exposes the stock to a near vacuum as it passes through the extruder and before it reaches the die.

The curing tank is of welded stainless-steel construction and should be insulated with at least two inches of rock wool or similar material. A container of sheet metal for protection against leakage from the working tank and also to contain and protect the insulating material should also be provided. Heat is supplied in the working tank by electric immersion heaters with a total output of 5,500 watts. Either a flat stainless-steel belt or roller rack designed to operate within the tank is required to transport the extrusion through the curing medium.

A hood and exhaust system to remove fumes from the LCM and the hot extruded material on the wind-up is necessary. Also, a cleaning or cooling tank is required following the curing tank.

Heat Transfer Media

Either molten metals or certain oils can be used as the heat transfer medium, and there are advantages for both types of media. Molten metals can be used

²Vacuum extruders of this type are covered by United States patent No. 2,774,105, assigned to Du Pont. Machine manufacturers desiring a license should write Patents and Contracts Division, Polychemicals Department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

³American Smelting & Refining Co., Federated Metals Division, New York, N. Y.

⁴Esso Standard Oil Co., New York.

⁵Dow Corning Corp., Midland, Mich.

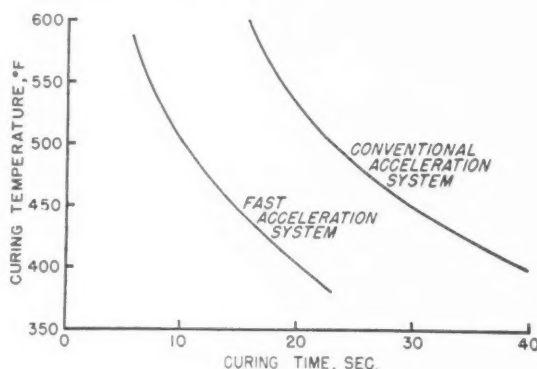


Fig. 3. Cure rate of 1/4-inch i.d. and 1/2-inch o.d. tubing vulcanized in molten metal with conventional and fast acceleration system

at higher temperatures, thus allowing faster cures. The biggest disadvantage of molten metal is probably its high density which develops pressure due to the weight of the metal and tends to distort extrusions of hollow cross-section with thin walls. There are a large number of low-melting alloys that can be used; Asarco 281,³ a eutectic mixture of 42% tin and 58% bismuth and melting at 281° F., has been used successfully.

Low-cost paraffinic-type petroleum oils, such as Teresso 140,⁴ or silicone oils such as DC-550 Fluid,⁵ can be used with neoprene extrusions.

Compounding and Curing

For a high production rate in a curing bath of practical length, a very fast cure rate is desirable, and the thiourea and aldehyde amine accelerators are effective in providing for fast cures in neoprene. The cure rate can be further increased by using a combination of five parts of litharge and five parts of zinc oxide for dark-colored compounds and two parts of zinc oxide for light-colored.

EXTRUDED SECTION

ML 2 1/2
AT 212°F



35



42



52



68

Fig. 4. Porosity vs. viscosity in LCM extruded sections. Compounds differed only in viscosity from 35 to 68 Mooney viscosity



NORMAL
EXTRUDER



VACUUM
EXTRUDER

Fig. 5. Elimination of porosity in a very soft compound by means of vacuum extrusion

Scorching is controlled by pelletizing the base stock and dusting a measured amount of accelerator on the surface of the pellets or dripping molten accelerator on to a uniform strip of stock from the warm-up mill and taking advantage of the mixing action in the extruder to disperse the accelerator. Neoprene compounds accelerated in this manner can be cured in about 20 seconds at 425° F. and have physical properties very similar to those obtained from a conventional press cure.

It is also possible to extrude and cure conventionally accelerated neoprene compounds by the LCM method. Such compounds require about twice the time at any given temperature to produce the same state of cure, and by raising the curing temperature about 100° F., cures in the same time as at the lower temperature may be obtained without the need of an excessively long curing tank. Figure 3 shows the cure rates of tubing cured with a conventional and a fast-curing accelerator system.

Porosity

The elimination of porosity in solid extrusions is dependent upon compound viscosity, cure rate, and extruder design. Obviously, materials such as plasticizers that are volatile should be avoided in compounds that are to be cured by the LCM process.

It is also necessary to eliminate the entrapped air that is normally found in rubber compounds. With many stocks harder than 70 durometer the viscosity

of the uncured stock is high enough to work the air out in the extruder. As the compound viscosity decreases, the porosity increases, as can be seen in Figure 4. The extruded cross-sections shown were made from four similar compounds varying only in the amount of carbon black which they contained.

The viscosity of compounds below 70 durometer hardness can be increased as follows: (1) Use Neoprene Type WHV. In lightly loaded compounds blend Type WHV with another type of neoprene to reduce nerve, if necessary. (2) Use reinforcing types of fillers such as SRF or FEF carbon blacks and keep MT carbon black and mineral fillers to a minimum to avoid soft, mushy stocks.

Extruder operating conditions and design also influence porosity. Lower extrusion temperatures have the same effect as increasing the compound viscosity; however, there is obviously a minimum temperature limit below which rough extrusions would result. Higher extrusion speeds will also reduce porosity. To obtain the maximum use of the LCM process, a vacuum extruder is recommended because conventional compounds with hardnesses as low as 40 durometer, non-black compounds, and very highly extended compounds can be run.

With very soft compounds (40 durometer hardness) higher extrusion speeds are required to eliminate all the porosity. As the speed is increased from 20 to 70 rpm., the porosity decreases until it is not detectable.

Vacuum extruders can be designed whereby the vacuum is applied through the barrel wall or through the screw. At the present stage of development the vacuum screw appears to be the most effective for eliminating porosity. (See Figure 5.)

CV Sponge

The LCM process is also adaptable to the continuous extrusion and curing of unicellular neoprene sponge. It provides a rapid and economical method of preparing sponge products having a wide variety of shapes, sizes, and physical properties.

When compounding neoprene for extruded sponge applications, it is important to obtain the proper uncured viscosity. If the viscosity is too high, the sponge will not expand sufficiently, and if it is too low, the extrusion

will tend to distort during the curing operation. The viscosity can be controlled very easily by using the correct blend of Neoprene Type WHV with Type W or WRT.

Neoprene sponge compounds of the proper type extrude very smoothly; however, extruder temperatures somewhat higher than normal are recommended for best results, that is, 200° F. on the die and head and 160 and 180° F. on the barrel.

LCM Process Applications

The LCM process is particularly attractive for extrusions that are produced in large quantities, but is adaptable to almost any type. Numerous automotive extrusions, both solid and sponge, lend themselves very well to this process.

In the building industry, sealing strips for curtain wall constructions represent another sizable market. In this field the lower processing costs improve the competitive position of elastomers *versus* thermoplastic polymers. Miscellaneous extrusions such as pipe gaskets, milk tubing, washing machine drain hose, etc., can be cured by the LCM process, which also may be used with elastomers other than neoprene.

The wire and cable industry may find the LCM process economically attractive, particularly those companies contemplating additional processing equipment installations. The lower capital investment and the reduced floor space required could be deciding factors.

There are undoubtedly many other applications in which the LCM process can be used to advantage. It is expected that this method will be widely utilized by many extruded goods manufacturers to improve their competitive position in the complex elastomers and plastics fields.

80% Cis-Polybutadiene

(Continued from page 80)

-60° C. These data are shown in Figure 9.

SBR 1500 was observed to have a slightly greater resilience than natural rubber at 100° C., but the curves crossed in the vicinity of room temperature, showing a higher value for natural rubber down to -80° C.

While the curve relating resilience and temperature of the *cis*-polybutadiene did not reach a minimum value as the others did in the temperature range studied, it is probable that this minimum would be observed at some lower temperature. The shape of this curve and the shape of the right-hand portion of the other curves are very similar. A value of 0% resilience was observed for natural rubber only. It is postulated that 0% resilience should also be observed for the other rubbers if the measurements had been made at the precise temperature at which the pellet stopped oscillating as an elastomer.

At temperatures below the point of minimum re-

silience the oscillograph arm did not undergo harmonic motion, but made a single rebound before settling to equilibrium. The oscillograms in Figure 10 which depict these effects show the 80% *cis*-polybutadiene pellet to be oscillating in the normal manner at -60° C., while the other rubbers are very loggy. The lowest temperature at which natural rubber and emulsion polybutadiene gave an oscillogram of the regular form was -30° C. SBR 1500 gave no indication of resilience at this temperature.

Conclusions

The results presented in this paper indicate that the 80% *cis*-polybutadiene used should be serviceable to a much lower temperature than natural rubber, styrene-butadiene cold rubber, or emulsion polybutadiene.

There appears to be very little tendency for this 80% *cis*-polybutadiene to crystallize under any of the conditions studied.

It is concluded that when such a polymer becomes commercially available, it will be of interest, and will be much superior to SBR or natural rubbers for Arctic service or wherever these outstanding low-temperature properties are needed.

Acknowledgment

The authors wish to acknowledge the preparation of the polybutadiene rubber by J. H. Carroll and P. F. Rion. We also wish to thank W. W. Crouch and J. R. Haws for their suggestions and assistance.

Material Testing for Atomic Aircraft

The Materials Laboratory at the Philadelphia Navy Yard is conducting experiments on rubber, plastics, and synthetic textiles in connection with the development of materials to withstand the heat and radiation effects which would exist in atomic-powered aircraft. The Navy is vigorously pursuing the development of a nuclear-powered aircraft, based on the need of a long-range, long endurance, turbo-prop seaplane for use in anti-submarine warfare, air early warning, and cargo transport.

The material studies being conducted at Philadelphia employ a newly designed testing apparatus containing cobalt 60, a radioactive isotope. The apparatus includes eight sample compartments, each large enough to hold foil-wrapped specimens, and a large inner tank for testing liquids and greases. The compartments slide down into the radiation area and can be lifted high enough to remove and add test samples.

The Materials Laboratory is directed by Capt. James W. Klopp, USN, and access to the radiation laboratory and scheduling of tests are controlled by a qualified health physicist, Miss Eleanor Th. Vadala, who studied at the Oak Ridge National Laboratory which is located in Tennessee.

A Study of the Moisture Adsorption Properties of Carbon Blacks—II¹

By E. M. DANNENBERG and W. H. OPIE, JR.

Godfrey L. Cabot, Inc., Boston, Mass.

THE following installment concludes the informative article on the moisture adsorption properties of carbon blacks which was begun in our March issue.

H₂O Adsorption of Heat-Treated Channel Blacks

The dominating influence of chemisorbed surface oxygen on moisture adsorption in the region of lower partial pressures has been reported for other forms of carbon. McDermot and Arnell (15)² showed that the removal of oxygen from the surface of coconut-shell charcoal by treatment with hydrogen at 1000° C. diminished the water adsorbed during the first stages of sorption without changing the surface area of the charcoal. Healey, Yu, and Chessick (16) found that the oxidation of Graphon caused an adsorption increase in the partial pressure range up to 0.5-0.6. In contrast to these results, Emmett and Anderson (7) observed a complete shift of the adsorption isotherms of channel blacks in the direction of higher partial pressures by degassing in the temperature range of 1000-1200° C.

Since the thermal decomposition of carbon surface complexes depends on temperature, it would be expected that the activity of the adsorbing surface would also depend on its temperature history. Schaeffer, Smith, and Polley (17) have shown that the oxygen surface complexes are completely decomposed at about 1000° C.; whereas the evolution of chemisorbed hydrogen ceases at a temperature above 1200° C. The temperature range of 800-1200° C. is probably critical in determining the nature and the activity of the carbon black surface. The liberation of surface oxygen at relatively low temperature has been shown to affect only the initial part of the water adsorption isotherm. Heating of channel black at temperatures of 2700° C. causes crystallite growth, almost complete removal of surface complexes, and a profound reduction in water adsorption properties. Because these different phenomena have not been completely understood, the changes occurring during heating in the temperature range of 1000-1200° C. have been assumed to be caused entirely by the loss of chemisorbed oxygen.

In order to establish the temperature required to effect the large change in adsorption properties observed

TABLE 3. H₂O ADSORPTION OF HEAT-TREATED SPHERON 6 (MPC)

Temperature, °C.	Volatile Surface Area %	Nitrogen Surface Area m ² /Gram	% H ₂ O Adsorbed @ Rel. Humidity		
			31	55	79
Raw material @ R. T.	4.6	112	1.66	2.35	3.25
750	1.9	161	1.37	2.84	4.16
1000	0.8	127	0.34	0.81	1.50
1200	0.4	87	0.22	0	0.11
2700	0.1	86	0.22	0	0

for heat-treated channel black, samples of Spheron 6 (MPC) black were measured after induction furnace heating in an inert atmosphere for a period of two hours at various temperatures. The water adsorption data for this series of samples are shown in Table 3. Table 3 also lists the changes in "volatile" and surface area at the various temperatures. Surface area first increases as "volatile" is lost since the chemisorbed oxygen is liberated as CO and CO₂, removing carbon and increasing surface porosity. At the higher temperatures the surface area decreases observed may be due to sintering or to a reduction in surface roughness due to crystallite growth.

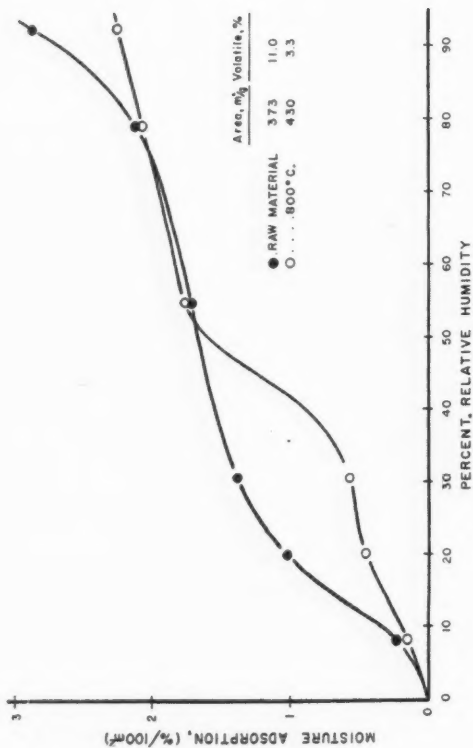
As can be seen from Table 3, the marked change in adsorption occurs on heating in the temperature range of 750-1200° C. Heating above 1200° C. has little additional effect. The increase in adsorption observed at the 55 and 79% relative humidities for the sample heated at 750° C. is due to an increase of surface area. The decrease in adsorption at the 31% relative humidity for the 750° C. sample confirms previous observations on the influence of "volatile" or chemisorbed oxygen.

In order to accentuate the effect of "volatile" loss on adsorption another series of samples was prepared from Mogul black in the temperature range up to 800° C. Mogul black is characterized by a "volatile" content of 11-12%, compared with the 4-5% volatile content of Spheron 6. The data for Mogul black are given in Table 4.

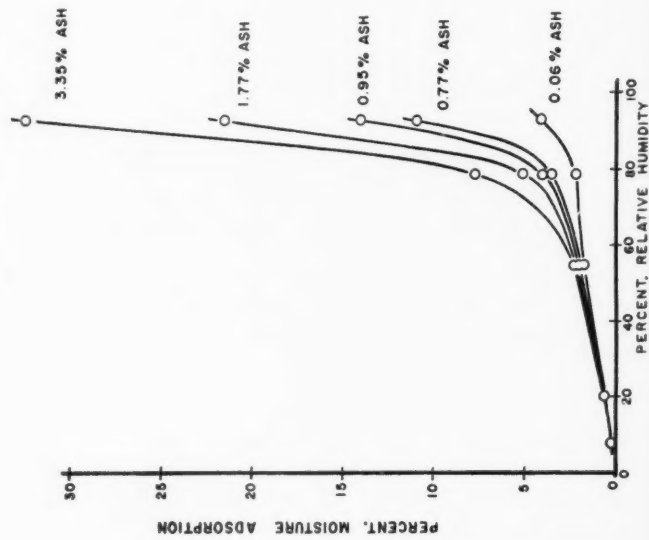
The marked decrease in adsorption with increasing temperature of heating for the 20 and 31% relative humidities is related to the observed decrease in "volatile" content. Since no significant change in moisture adsorption occurs at the higher humidities of 55 and 79%, it

¹ Presented at the joint meeting of Division of Rubber Chemistry, ACS and CIC, Montreal, P.Q., Canada, May 16, 1957.

² Numbers in parentheses refer to Bibliography items on page 855 of our Mar., 1958, issue.



(Upper Left)
Fig. 6. Effect of heat treatment on H₂O adsorption of Mogul black



(Left)
Fig. 8. Effect of added ash content on adsorption of HAF black

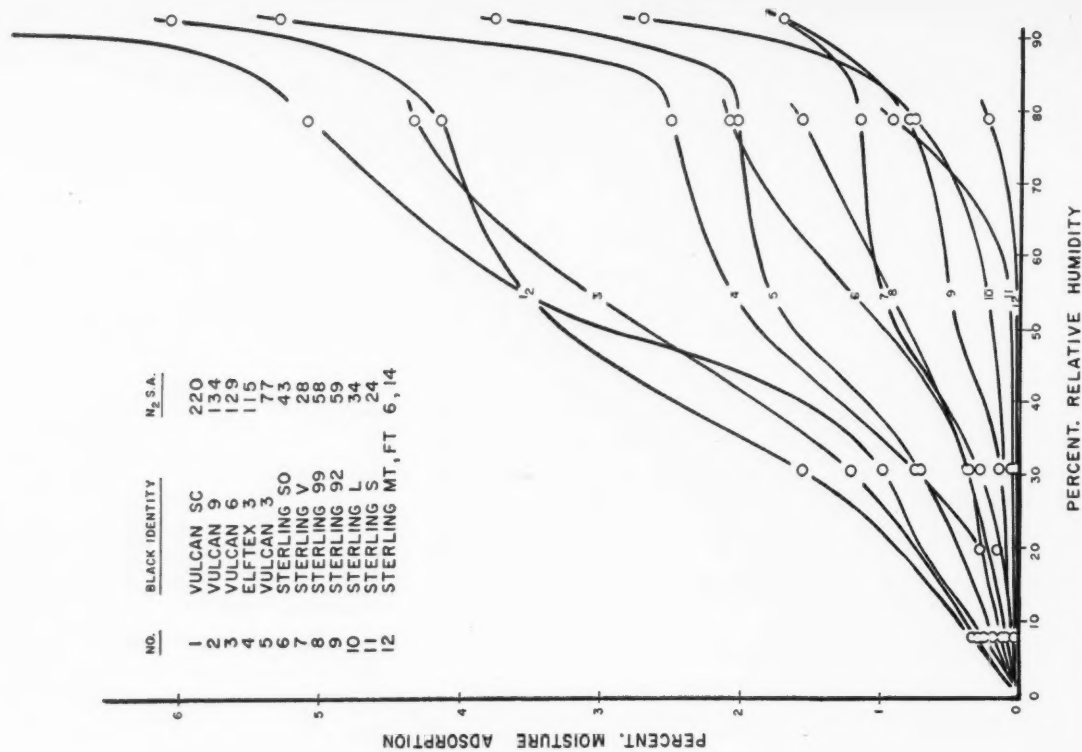


Fig. 7. Adsorption isotherms for furnace and thermal blacks



TABLE 4. H₂O ADSORPTION OF HEAT-TREATED MOGUL BLACK

Temperature, Volatile °C. %		Nitrogen Surface Area m ² /Gram	% H ₂ O Adsorbed @ Rel. Humidity			
			20	31	55	79
Raw material						
@ R. T.	11.0	373	4.02	5.02	6.52	8.03
400	10.3	375	3.68	5.46	6.50	7.83
600	7.3	410	2.85	4.49	5.92	8.46
800	3.3	430	1.90	2.33	7.56	9.03

can be assumed that, except for the removal of chemisorbed oxygen, the nature of the surface is not drastically altered by heating below 800° C. This point is shown more clearly in Figure 6 for the isotherms of the original Mogul raw material and the 800° C. sample. To correct for the surface area change due to "volatile" loss, the data in this figure are plotted as % adsorption per 100 m² of surface area.

As shown by the previous Spheron 6 series, heating in the temperature range of 800-1200° C. causes a sharp reduction in moisture adsorption at all humidities. This change of surface nature from a hydrophilic to an almost completely hydrophobic character may be associated with the loss of chemisorbed hydrogen which occurs in this temperature range. Further heat treatment at temperatures above 1200° C. has relatively little effect on moisture adsorption.

It is of interest to note that the rubber reinforcing properties of carbon blacks are also altered markedly by heat treatment (17). The removal of chemisorbed oxygen from channel blacks by calcining at temperatures of 600-800° C. results in a faster rate of vulcanization, a higher modulus, and improved laboratory abrasion properties for the black-rubber compound. Heat treatment at 1000-1200° C., the same temperature range which changes the surface nature from hydrophilic to hydrophobic, produces a black which imparts very much lower modulus and a lower level of reinforcement to rubber.

H₂O Adsorption of Furnace and Thermal Blacks

The furnace and thermal grades of carbon black are produced by incomplete combustion or thermal cracking of gaseous and liquid hydrocarbons. They are characterized by a lower surface area range than the channel blacks, lower "volatile" contents, and the presence of traces of inorganic contaminants and hydrocarbon extractable matter. The blacks used in this study are shown in Table 5.

The water adsorption isotherms are shown in Figure 7. They are S-shaped with a marked upswing in the region close to saturation. The nitrogen surface areas are also given in Figure 7. It is obvious that higher moisture adsorption is obtained with the blacks of small particle size and high surface area. In a number of cases, however, lower surface area grades begin to show some-

what greater moisture adsorption than blacks of higher surface area at a relative humidity of 79%. Examples of this anomalous behavior are Vulcan 9-Vulcan 6, Vulcan 3-Sterling SO, and Sterling L-Sterling S. From an examination of the analytical properties of the blacks showing these reversals it was found that in each case the ash content was slightly greater for the lower surface area black than for the higher area black. It was therefore suspected that the small residual quantities of inorganic contaminants, measured as ash on ignition, had a significant influence on moisture adsorption in the high humidity range.

In order to verify this possibility, samples of a black containing varying amounts of "ash" were prepared, and their moisture adsorption properties measured. These samples were prepared by adding the inorganic salt residue from a water-extracted Vulcan 3 black to the extracted black in controlled amounts. An analysis of the salt residue showed it to consist of a mixture of sodium, magnesium, and calcium sulfates and chlorides. These salts have their origin in the quench waters used to cool the hot, carbon-laden combustion products in the furnace process. The adsorption isotherms for these samples having "ash" contents from 0.06 to 3.35% are shown in Figure 8.

The higher quantities of "ash" are not normal to commercial carbon black grades, but were prepared for the purpose of accentuating the influence of soluble ash. It is to be noted that the isotherms are not changed significantly by the presence of "ash" below a relative humidity of 55%, but separate sharply in the high relative humidity range. The very large amount of water adsorbed at the 93% relative humidity as the result of the presence of a few per cent. of soluble salts suggests the formation of solutions of these salts on the black

TABLE 5. PROPERTIES OF FURNACE AND THERMAL BLACKS

Trade Name	Type	Electron Microscope Data			Total Area by N ₂ Adsorption (m ² /Gram)	Porosity Factor N ₂ Area/ E. M. Area
		d _a Å	d _h Å	Calc. E.M. Surface Area (m ² /Gram)		
Vulcan						
3	HAF	235	436	74	77	1.04
6	ISAF	175	267	121	129	1.07
9	SAF	138	228	142	134	0.94
SC	CF	162	270	119	220	1.85
Elftex 3	Ink					
	grade	—	—	—	115	—
Sterling						
SO	FEF	382	561	58	43	0.74
V	GPF	524	747	43	28	0.65
99	FF	396	561	57	58	1.02
L	HMF	599	860	38	34	0.90
92	Ink					
	grade	507	624	52	59	1.13
S	SRF	824	1060	31	24	0.78
FT	FT	2110	2340	15.2	13.7	0.90
MT	MT	4720	5660	5.7	6.6	1.16

surface. Various carbon blacks produced in different locations will vary in quantity and composition of the inorganic salt contaminants so that the detailed results shown here are not strictly applicable to all products. It is felt, however, that the presence of inorganic salts will, in general, give rise to enhanced adsorption in the high relative humidity range.

In order to correlate nitrogen surface area with moisture adsorption for furnace blacks, it was necessary to use the highest relative humidity at which an insignificant influence of salt content on adsorption was obtained. Figure 9 shows the data for moisture adsorption at a 55% relative humidity for the furnace and thermal blacks. The oil furnace blacks give a straight line lying above the lines for gas furnace and thermal blacks. This indicates that the specific surfaces of gas furnace and thermal blacks are more hydrophobic than oil furnace blacks.

H₂O Adsorption of Rubber-Black Mixtures

If carbon black, having its normal moisture content, is mixed with rubber on an open mill, most of the moisture is lost by evaporation due to the heat developed during mixing. Re-adsorption of moisture can occur during storage of the compound in a humid atmosphere, and it was therefore of interest to determine whether carbon black, after incorporation in a rubber compound, and before vulcanization, could have an effect on moisture adsorption.

A series of rubber-carbon black mixtures was prepared containing 50 parts of black and 100 parts of SBR 1500, using a two-roll laboratory rubber mill. The stocks were taken off the mill in thin sheets which were

TABLE 6. EQUILIBRIUM MOISTURE ADSORPTION BASED ON CARBON BLACK CONTENT OF 100 RUBBER-50 CARBON BLACK MIXES AT 22-23° C. AND A RELATIVE HUMIDITY OF 55%. VALUES ARE FOR 2,700 HOURS AND ARE CORRECTED FOR MOISTURE ADSORPTION OF THE GUM RUBBER

Carbon Black Grade in Mix	Porosity Factor	Time in Hours to Reach 90% of Equilibrium	W _M % Adsorp. of Black in Mix	W _o % Adsorp. of Orig. Black	W _M /W _o
Carbolac 46	5.2	700	1.20	14.0	0.09
Mogul Special	2.9	240	4.30	8.93	0.48
Monarch 71	2.8	200	2.87	5.20	0.55
Spheron 9	1.1	160	2.50	2.63	0.96
Vulcan 3	1.0	1200	2.00	1.80	1.11
Sterling SO	0.74	1200	1.14	1.20	0.95
MT	0.89	—	0.00	0.03	—
Graphon	0.64	—	0.07	0.00	—

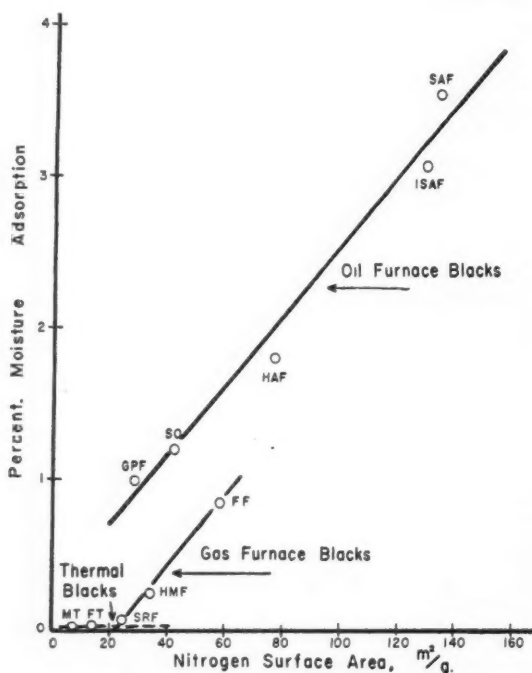


Fig. 9. Adsorption at 55% relative humidity versus nitrogen surface area

cut up into small pieces for moisture adsorption samples. A group of blacks was chosen which showed a wide variation in moisture adsorption properties. The rubber-black samples were vacuum dried at room temperature for 72 hours and placed in a 55% relative humidity chamber from which they were removed periodically for measurement. A sample of the unloaded SBR 1500 rubber was also measured in order to establish the moisture adsorption which was due to the rubber component of the rubber-carbon black mixtures. The total adsorption of the mixtures, corrected for the adsorption of the rubber phase, was taken as being caused by the presence of the carbon black. At a 55% relative humidity the correction for the adsorption of the rubber phase was small. At a higher humidity of 79% this correction was so large that the determination of the adsorption due to the carbon black was not too accurate. For this reason Table 6 lists data obtained at a relative humidity of 55% at room temperature.

It would be anticipated that the rate of approach to equilibrium would be considerably longer for the rubber-carbon black samples than for the carbon blacks themselves. For the rubber-black samples the adsorption process depends upon the relatively slow rate of diffusion of water vapor molecules in the rubber phase. In most cases equilibrium was essentially established in 2-3 months for the rubber-black samples, compared with 1-10 days for the original carbon blacks. Table 6 lists the time required to reach 90% of the final equilibrium values. These values are, of course, dependent on the physical dimensions of the sample granules and have only a relative significance. The two furnace black samples, containing Vulcan 3 (HAF) and Sterling SO (FEF), appear to approach equilibrium more slowly than the other samples which contain the channel and ink-grade carbon blacks. This is in line with the rates of moisture adsorption previously shown for these blacks. The fact that the carbon blacks still show an effect on moisture adsorption rates in rubber indicates that the rate of the adsorption process is not completely controlled by the rate of water vapor diffusion in the rubber phase.

Table 6 shows the equilibrium moisture adsorption values for the blacks in the rubber mixtures, compared with the adsorption for the blacks themselves under the same humidity conditions. For those blacks having a high degree of porosity, as shown by the porosity factor, the adsorption in the rubber mixture is substantially less than for the "free" black, suggesting that the internal particle surface is not effective in the adsorption process. That the external particle surface is completely effective is shown by the remarkable correspondence of the adsorption values for the non-porous blacks in rubber and in their normal condition. The ratio of the two adsorption values W_M/W_0 is essentially unity for the non-porous rubber-grade carbon blacks, Spheron 9 (EPC), Vulcan 3 (HAF), and Sterling SO (FEF). Sterling MT and Graphon, being almost completely hydrophobic in their normal state, show the same behavior after mixing with rubber.

The fact that the carbon-rubber interface in unvulcanized stocks is almost totally effective for the adsorption of water vapor, as is the free carbon surface, gives rise to some interesting speculations regarding the nature and extent of the carbon black-rubber interface. Certainly the fraction of surface area which is chemically bonded to the rubber phase, if present, must be negligibly small for this phenomenon to occur.

A recent publication of Watson (18) showing that if any chemical interaction between carbon surface and rubber occurs, it probably takes place during the vulcanization reaction, and not during the milling of rubber, supports the conclusion that the surface of carbon black in the unvulcanized stocks is still essentially free for gaseous adsorption. In this connection, Van Amerongen (19) has also shown that the capacity of carbon black for adsorbing gases is partially retained after the black is incorporated into vulcanized rubber.

It is also evident that the surface coverage due to physically adsorbed rubber is either of relatively small magnitude, or that the water molecules displace any physically adsorbed rubber at the interface since the quantities of water adsorbed at a relative pressure of 0.55 correspond almost to a complete monolayer for the non-porous blacks. This is an interesting example of gaseous adsorption at a solid-solid interface. Adsorption of low molecular weight components such as accelerators, sulfur, antioxidants, etc. by fillers in rubber compounds has been suggested in the past by numerous investigators in order to explain the changes in degree and rate of vulcanization observed after filler incorporation, but little direct evidence for such adsorption has been presented. That such adsorption phenomena actually do occur seems to be more likely in view of the results described here.

Summary and Conclusions

A technological investigation of the moisture adsorption properties at various relative humidities of a complete range of commercial rubber and ink grades of carbon blacks and a series of heat-treated MPC blacks was made.

A number of conclusions can be made based on the data obtained. The rates of moisture adsorption for

channel blacks are faster than for furnace blacks. Moisture adsorption in the lower humidity range is dependent more on volatile content than it is on specific surface area. In the high-humidity range adsorption depends on surface area. Equilibrium moisture adsorption data at a low and at a high humidity can be used as an approximate method for determining both the volatile content and surface area of channel-grade carbon blacks. At humidities greater than 90% moisture adsorption is sharply affected by bulk density, indicating the occurrence of inter-particle capillary condensation.

The high-temperature treatment of carbon black causes marked changes in moisture adsorption capacity, particularly in the temperature range where hydrogen evolution occurs. Heat treatment at a lower temperature results in a decrease in moisture adsorption in the lower humidity range without affecting the adsorption in the higher humidity range. This confirms the effect of chemisorbed oxygen previously observed for the commercial grades of channel and "after-treated" channel blacks.

The ash content of furnace-grade carbons is shown to have some influence on moisture adsorption in the high-humidity range. At a humidity of 55% where ash content has an insignificant effect, it is possible to show a good correlation between adsorption and surface area for the furnace-grade carbons.

It is shown that a masterbatch of carbon black and rubber will adsorb moisture at a very low rate in quantities related to the particle size and type of carbon black. The fact that the carbon black surface in rubber is still almost totally active in its ability to adsorb polar molecules has some interesting fundamental implications regarding the nature of the rubber-carbon black interface. This is a most interesting example of gaseous adsorption at a solid-solid interface.

Alkali Metal Polymerization Review

An understanding of polymerizations initiated by alkali metals, known for many years, is only now beginning to emerge, according to Hugh E. Diem and Harold Tucker, of The B. F. Goodrich Co., in a paper given before the Division of Industrial & Engineering Chemistry, ACS, in San Francisco, Calif., in mid-April.

The alkali metals appear to initiate anionic polymerizations which are unterminated. The effect of small concentrations of impurities is pronounced. The range of monomers susceptible to such polymerization is limited, and copolymers are relatively rare, as compared to free radical polymerizations. This may be accounted for by the paramount importance of the polarity of the monomer. There are indications that stereospecific polymerizations can occur.

In particular, the specificity of the polymerization of isoprene with lithium or its alkyls is well known, and the remarkable specificity brought about by the introduction of very small amounts of certain ethers has been demonstrated.

The Special Stockpile Advisory Committee Report of January is being reviewed by the executive branch of the government, and an Administration decision on policy is expected by July. Finished products mobilization needs are now getting increased emphasis. Congressional action on stockpile policy is not likely until late 1958.

The Government alcohol-butadiene plant at Louisville, Ky., may now be sold to industry since the Publicker Industries' lease has expired, but buyer interest is much less than a year ago when possible sale was blocked by the Senate farm group.

Legislation on marketing practices in S-11 and S-3079 is making slow progress, and prospects for enactment into law dimmed appreciably in March. Industry pricing procedures would be restricted by these Senate bills.

The Sadlak bill (HR 9291) to plug loopholes in rubber-soled footwear tariffs has a good chance of passage this year. Bill has been reported out of committee and has approval of State and Treasury.

New engineering data handbook on molded, extruded, lathe-cut, and chemically blown sponge rubber products being distributed by the Rubber Manufacturers Association to help the industry's customers improve specifications for their rubber component requirements.

Continuous curing of neoprene extrusions by means of a liquid curing medium was announced by Du Pont. The new method is expected to improve the competitive position of extruded goods manufacturers. Du Pont has also announced greater availability of its "Viton" fluorine-containing elastomer because of production from a new plant.

Symposium on High-Temperature Resistant Elastomers will feature the May 14-16, Cincinnati, O., meeting of the Rubber Division of the American Chemical Society. Several papers on urethane elastomers, latices, and on vulcanization and reinforcement phenomena are also included in this program.

"The Use of Textiles in the Rubber Industry," a symposium of the Philadelphia Rubber Group, included papers on tire cord, textiles in industrial rubber products, and a review of all rubber industry textile applications, together with informative answers to a great many questions on this subject.

MEETINGS

and REPORTS

Rubber Division Cincinnati Plans Include Symposium, Ladies Program

The seventy-third meeting of the Division of Rubber Chemistry, ACS, will be held in Cincinnati, O., May 14, 15, and 16, at the Netherlands-Hilton Hotel. This meeting, which will be held separately from the parent Society, will be featured by a "Symposium on High Temperature Resistant Elastomers," of invited and contributed papers, on May 15; the usual luncheon-meeting of the Division's 25-Year Club on May 14; the Division banquet on the evening of May 15; and a special program for ladies attending the meeting with their husbands.

R. F. Dunbrook, Firestone Tire & Rubber Co., Division chairman, will preside at the first technical session on Wednesday afternoon, May 14, and at the business meeting on Thursday morning and the banquet on the evening of the same day. E. R. Bartholomew, Wright Air Development Center, will preside at the second technical session on the morning of May 15, at which the invited papers of the symposium will be presented; and E. N. Cunningham, Precision Rubber Products Corp., and chairman of the committee on local arrangements, will preside at the May 15 afternoon session when the contributed symposium papers will be given. The chairman for the final session, on the morning of May 16, will be Sheldon Nicol, Goodyear Tire & Rubber Co., director-at-large.

The local committee, headed by Mr. Cunningham, emphasizes the many cultural and scenic attractions of Cincinnati—the Art Museum, the Museum of Natural History, the University of Cincinnati, and Xavier University, and the well-known Cincinnati Zoo. The ladies' program includes a bus tour of Cincinnati with a 30-minute stopover at the famous Krohn Conservatory, and a boat trip down the Ohio River.

On Wednesday morning, May 14, and again at the end of the first technical session on the same day, there will be special showings of a moving picture entitled, "High-Speed Photography in the Rubber Industry," by the Firestone company.

Other members of the local committee include J. M. Kelbe, WADC;

J. R. Wall, Inland Mfg. Division, General Motors Corp.; and F. W. Gage, Dayton Chemical Products Laboratories, as vice chairmen; Don N. Bertke, Texco Corp., finance; Boris Sway, Texco Corp., ladies' program; W. F. Herbert, Jr., Dow Corning Corp., information; R. E. Wells, Precision Rubber Products, registration; Mr. Gage, publicity; J. M. Williams, Amsco Solvents Co., banquet; C. L. Zimmerman, C. L. Zimmerman Co., housing; and S. J. Miller, Dubois Co., program and meeting rooms.

The Division banquet will start at 6:45 p.m., Thursday evening, May 15, and will provide an excellent meal and good, fast moving entertainment, according to the local committee.

The next meeting of the Division is scheduled for Chicago, Ill., September 9-12, and the deadline for 250-word abstracts of papers for that meeting is June 5. The abstracts should be sent to R. H. Gerke, United States Rubber Co. Research Center, Wayne, N. J.

Program and Abstracts of Papers

Wednesday Morning—May 14
9:00 a.m.—Registration.

11:00 a.m.—High-Speed Photography in the Rubber Industry. G. L. Hall, J. D. Rigby, F. S. Conant,¹ J. W. Liska, Firestone Tire & Rubber Co., Akron, O.

This special 20-minute moving picture presentation is a demonstration of the use of a high-speed camera (up to 3,000 frames a second) as applied to the study of materials processing and product testing in the rubber industry. Examples presented include observations of cord winding apparatus, tread wave motion in passenger-car tires at high speed, landing of airplane tires, tires going over a cleat on a test drum, tires cornering on a test drum, and a racing car on the Indianapolis Speedway. Illustrations are given of data obtainable from measurements on frame-

¹Names in bold face indicate person presenting paper.

by-frame projections. These include axle motion caused by a tire running over a cleat; the breaking of individual tire cords by a pendulum apparatus; and the determination of the speed of a solenoid-type low-temperature brittle-point apparatus.

Some of the techniques used in experimental design, photograph and data analysis are given. These include a method for obtaining two scenes on a 100-foot roll of film, each scene being photographed at full camera speed. Suitable applications as well as limitations of the high-speed camera in the study of rubber behavior are pointed out.

11:30 a.m.—25-Year Club Luncheon Meeting. H. S. Karch, C. P. Hall Co., Akron, chairman.

Wednesday Afternoon—May 14
Urethanes, Latices, Etc.
R. F. Dunbrook, Presiding

2:00 p.m.—1. Introductory remarks.
R. F. Dunbrook.

2:05 p.m.—2. Chemistry of Aryl Isocyanates: Rate and Equilibrium Constants for the Formation and Decomposition of Ethyl α , γ -Diarylallophanates. I. C. Kogon, E. I. du Pont de Nemours & Co., Inc., elastomer chemicals department, Wilmington, Del.

The equilibrium and rate constants for the formation of ethyl α , γ -diarylallophanates from aryl isocyanates and ethyl substituted carbanilates at 106-143° C. have been measured.

At equilibrium, the concentration of allophanate decreases with increasing temperature. Substitution of a paramethyl group on the aromatic ring of the carbanilate decreases the concentration of allophanate, compared to the unsubstituted and ortho-methyl substituted carbanilate.

Similarly, substitution of an ortho-methyl group on the aromatic ring of the carbanilate increases the rate of reaction with phenyl isocyanate, compared to the unsubstituted and paramethyl substituted carbanilate. The mechanism of this reaction will be discussed.

Tertiary amines such as *n*-methyl morpholine do not exert any catalytic effect on the rate of formation of ethyl α , γ -diarylallophanate.

Decomposition studies of some aryl biurets and ethyl α , γ -diphenylallophanate show that aryl biurets are less stable than ethyl α , γ -diarylallophanate. Substitution of the aryl group with an alkyl group increases the stability of the biuret.

2:30 p.m.—3. Gelation and Viscosity Control in Isocyanate Reactions. R. P. Kane, I. C. Kogon, H. W. Bradley, Du Pont, elastomer chemicals and organic chemicals departments.

It is well known that undesirable gelation reactions in the preparation

and storage of liquid polymers from diisocyanates and polyols can be tempered or avoided entirely by judicious employment of acidic additives, e.g., acid chloride.

It is known also that gelation reactions are sometimes prevented merely through use of a different lot of the same diisocyanate, and for this reason the source of difficulty often has been ascribed to the diisocyanate. The purity of the polyol is also critical.

This paper elucidates the interrelation of the hydrolyzable chlorine content of the diisocyanate with the purity of the polyol. The observed phenomena are illustrated in model compound studies as well as in typical commercial formulations. Methods for avoiding undesirable side reactions are presented.

2:55 p.m.—4. Liquid Urethane Elastomers. R. J. Athey, Du Pont elastomer chemicals department.

Fluid processing of elastomers has been an important objective in the rubber industry for years. Latexes, dispersions, or solvent solutions are used to meet most of the current needs of elastomers in liquid form. While these materials allow liquid processing, the problems of removal of water or solvent and lack of unusual properties compared to solid elastomers has limited the development of liquid processing. Advances in polyurethane chemistry have opened the way to a truly fluid polymer which can be transformed to a strong, elastic, rubber-like solid having unique properties, compared with conventional elastomers.

Adiprene L urethane rubber is an example of this approach to castable elastomers. It can be cast, sprayed, spread, or applied by dipping to produce a wide variety of mechanical goods or protective and decorative coatings. The curing process, which transforms the liquid polymer into a solid elastic rubber, varies from five minutes to 24 hours, depending on curing agent and conditions used.

Adiprene L vulcanizates exhibit high tensile strength and resilience combined with excellent resistance to abrasion, compression set, oils, oxidation and ozone. In addition, they exhibit excellent low-temperature properties.

The liquid nature of the polymer coupled with the unique combination of vulcanizate properties suggests its use in automated production of high-quality rubber goods.

3:15 p.m.—5. Polyurethane Foams: Stability, Collapse, and Shrinkage. H. K. Frensdorff, Du Pont elastomer chemicals and organic chemicals departments.

The physical factors affecting foaming behavior in polyurethane foams were studied on non-polymerizing model systems based on polytetramethylene ether glycol (M.W. 3,000). The effects of silicone additives on surface tension, foam growth, collapse,

bubble size, and bubble number were determined.

The results of these studies lead to the following conclusions. Bubble size increases during foaming, and the number of bubbles decreases continually owing to bubble coalescence. Collapse consists of the loss of a comparatively small number of very large bubbles. Silicones, because of their surface activity, delay collapse by decreasing the initial bubble size and by delaying the breaking of very large bubbles. The silicones exert their maximum stabilizing effect at very low concentrations, where the Gibbs surface excess is greatest.

Gas permeability measurements showed that polyurethanes were much more permeable to carbon dioxide than to air. When carbon dioxide diffuses out of a freshly prepared urethane foam more rapidly than air diffuses back into it, a pressure differential results, which causes shrinkage of the as yet incompletely cured foam.

3:40 p.m.—6. Effect of Swelling on Properties of Elastomers. C. B. Griffiths, Angus Wilson, J. C. Monterroso, Quartermaster Research & Engineering Center, Natick, Mass.

Measurements of volume increases of rubbers in liquids are often used as an indication of the change in properties of the rubbers in these liquids. Volume increase measurements are of little significance *per se*, unless the physical dimensions of a rubber component or item are critical. To be of value the swell measurements should disclose accompanying changes in the physical properties of the rubber. The studies reported here were undertaken to determine possible mathematical statements showing such relation.

Various types of rubber compounds of different states of cure were immersed in standard test fluids and in mixtures of methanol with benzene and ketone. After swelling equilibrium had been reached the % swell, tensile strength, ultimate elongation, hardness, and tear strength were determined. Percent losses in these properties were plotted against corresponding volume increases. Equations were found relating losses in physical properties to swell. They were of the form $L = \frac{s}{as + b}$ for all properties; where "L" is % loss in the property tested, "s" is % volume increase, and "a" and "b" are constants for a specific rubber compound. The values of "a" and "b" were found to vary between types of rubber, different cures of the same type of rubber, and the property tested.

A method is described for determining the change in certain physical properties of a given rubber item immersed in liquids when test samples cannot be cut from the item.

4:00 p.m.—7. The St. Joe Ozone Flex Tester for Rubber Compounds. L.

E. Carlson and R. S. Havenhill, St. Joseph Lead Co., Monaca, Pa.

The new laboratory machine for evaluating the ozone resistance of rubber compounds under static and dynamic conditions is described. The machine is compact (17 inches high, 12-inch square base) and tests small specimens 1/2-inch by one inch easily obtainable from standard tensile sheets.

The ozone concentration, of approximately 50 parts per hundred million, is maintained constant by passing a controlled quantity of compressed air (which is ozone-free) past a Westinghouse #794 Sterilamp.

The five specimens are alternately flexed 10 minutes and maintained in the bent position 50 minutes by an automatic cycling device. The dynamic feature is considered essential, since some additives which improve static ozone resistance actually accelerate dynamic attack.

The human element in rating degree of attack has been eliminated by measuring bend modulus with a special beam balance before and after exposure.

Electrostatic contact potential of rubber oriented by stretching is shown to be more negative than for unstretched rubber. This could account for the more rapid ozone attack on stretched rubber.

Results obtained with the new machine have shown good correlation with actual road tests on white sidewall tires in the Los Angeles area.

4:25 p.m.—8. The Influence of Particle Size on the Viscosity of Synthetic Latex—I. Effect of Polydispersity. Paul H. Johnson and Robert H. Kelsey, Firestone.

Three latexes, made in modifications of a single system using a 70/30 butadiene/styrene charge, possessed modal particle diameters, as determined with the electron microscope, of 950Å, 1710Å, and 325Å, respectively. The distribution of particles was contained in a sufficiently narrow range (ca 700Å) so that the mode adequately represented the particle population. These latexes were concentrated alone and in various blend ratios of small, medium, and large particles. Viscosities were run on the latexes with a Brookfield viscosimeter during the course of concentration. The viscosity behavior was normal and conformed to the well-known principle that larger particle size latexes are more fluid than those of small particle size.

The influence of particle size distribution was examined by making blends of the latexes in various combinations of sizes. Blends of 950Å with 3250Å diameters were made on an equal mass basis and on an equal surface basis. The mixtures had more favorable viscosity characteristics than did either of the single latexes. The blend on an equal surface basis could be taken to 67.5% solids.

Other experiments involving blends

of widely different number distribution showed that the mass relation of large and small particles gave a more significant indication of the viscosity behavior. The results of viscosity measurements on various blends showed that favorable viscosity is dependent upon (1) particle size: the larger the particles the more fluid is the latex; (2) particle size distribution. The difference between large and small particles should be large, and the mass of large should constitute around 75% of the total mass of particles.

4:45 p.m.—9. The Influence of Particle Size on the Viscosity of Synthetic Latex—H. Effect of Particle Spacing. Robert H. Kelsey and Paul H. Johnson.

From the simple geometric considerations of particle size and mean particle spacing, a relation between particle sizes in synthetic latices and the concentration limited by viscosity has been deduced, for substantially monodisperse systems.

An approximation to the Brookfield viscosity vs. concentration relation has been made from the mean particle spacing, using only one arbitrary constant.

A packing constant which holds its value well for a range of essentially monodisperse latices has been defined. It was found that it could be evaluated in any case from the volume concentration of polymer at which the viscosity increased beyond measure. This volume concentration has been found very close to 74% for latices of uniform particle size.

For latices having two principal sizes of particles, the packing constant assumed values corresponding generally to closer packing.

The use of the packing constant determined from the limiting concentration permitted satisfactory fit between the viscosity-concentration curves for mixed latices, experimentally determined and deduced from particle spacing data, with the use of one arbitrary constant.

5:00 p.m.—High-Speed Photography in the Rubber Industry. Hall, Rigby, Conant, Liska. (A repeat showing of this motion picture.)

**Thursday Morning—May 15
Symposium on High-Temperature Resistant Elastomers—I
Invited Papers**

E. R. Bartholomew, Presiding

9:00 a.m.—10. Introductory Remarks. E. R. Bartholomew.

¹A major portion of this work was conducted under USAF Contracts AF33(616)-3108 and AF33(616)-3953, administered under the direction of the Materials Laboratory, Directorate of Research, Wright Air Development Center.

²Trade mark of E. I. du Pont de Nemours & Co., Inc.

³B. F. Goodrich Chemical Co., Cleveland, O.

⁴Minnesota Mining & Mfg. Co., Jersey City Chemical Division, Jersey City, N. J.

9:05 a.m.—11. Properties of Elastomers up to 550° F. F. M. Smith, Firestone.

Industrial and military applications are subjecting elastomeric materials to ever-increasing temperatures, necessitating a knowledge of the heat resistance of currently available compounds and the development of still higher heat resistance.

Stress-strain properties for compounds of 19 elastomers were measured at temperatures up to 550° F. The initial loss of tensile strength at elevated temperatures was differentiated from that caused by a combined aging and temperature effect. Tear strength was measured at temperatures up to 500° F. Shore A hardness was measured at room temperature on blocks which had been aged one hour and eight hours at temperatures as high as 500° F. Resilience was measured over the —40° to 500° F. range by a falling ball rebound test. Low-temperature elastic properties of compounds can be anticipated from the temperature at which the minimum rebound occurs. Permeability of elastomers to air varied as much as one thousandfold at room temperature, but no more than twentyfold at 350° F.

The data presented should serve as a guide to the usefulness and limitations, at high temperatures, of the 19 elastomers tested.

9:30 a.m.—12. Viton®—Heat and Fluid Resistant Elastomer. W. V. Freed, Du Pont elastomer chemicals department.

The high performance requirements of today's advanced design in aircraft and automotive applications have exceeded the limits of operability of conventional elastomeric materials. A new synthetic rubber, Viton, has been developed to overcome many of the environmental problems of heat, corrosion, and chemical resistance. This fluorine-containing elastomer possesses excellent chemical and thermal stability with remarkable retention of elastomeric properties after prolonged exposures to temperatures in the range of 400 to 600° F. Resistance to attack by a wide variety of fluids including aromatic and aliphatic hydrocarbons, hydraulic fluids, chlorinated solvents and mineral acids and alkalis, has been clearly demonstrated.

Viton is fully processable by conventional elastomer techniques, and many Viton moldings have been successfully tested under extreme exposure conditions in aircraft, automotive and industrial applications. The conditions and results of these tests are described. Seals and gaskets of all types have received the widest attention because of the need of an elastomer flexible above 400° F. in a variety of fluids. Investigations directed toward the development of chemical resistant hose, bladder-type fuel cells, protective clothing, and aircraft tires will be discussed.

9:55 a.m.—13. Combined Effects of Heat and Gamma Radiation on Practical Rubber Compounds. E. E. Mooney, S. T. Semegen, J. W. Born, B. F. Goodrich Co. Research Center, Brecksville, O.

A study is under way of the separate and combined effects of heat and gamma radiation on practical rubber compounds. Two representative stocks were chosen for each of four major classes of aircraft products: namely, hose, seals, fuel cells, and wire insulation. Two recipe variations of each rubber compound were also included, involving separate incorporation of two potential radiation damage inhibitors. The elastomers were neoprene, styrene-butadiene rubber, and nitrile rubber.

Stress-strain and hardness measurements were employed to evaluate physical deterioration. The study involved gamma irradiations up to 126×10^8 ergs per gram of carbon and physical testing at room temperature and 158° F. This work has involved four sets of test conditions and is the first phase of continuing research intended to involve temperatures of 212 and 280° F.

The importance of equivalent cure was emphasized. The principal changes resulted from radiation exposures ranging up to 85×10^8 ergs per gram of carbon at room temperature and 34×10^8 at 158° F. Based on the exposure required to reduce the initial ultimate elongation by one half, the additives appear to give greater protection during irradiation at room temperature than at 158° F.

10:20 a.m.—14. Behavior of Some Elastomers in Petroleum-Base Fuel at Elevated Temperatures. R. G. Spain, Wyandotte Chemicals Corp., Wyandotte, Mich.

The degree of the recovery of physical properties of elastomer compounds after exposure to petroleum-base fuels does not form a basis for the estimation of the physical properties of the compound while at the conditions of aging. Equipment and procedures have therefore been developed to determine the physical properties of elastomer compounds at the simulated use conditions of fuel immersion at elevated temperatures.

Data are presented for compounds based on Hycar 1041,¹ Kel-F 3700,² and Viton A from conventional fuel aging tests and from tests conducted at elevated temperatures. High-temperature testing was conducted in the presence and the absence of petroleum-base fuel to differentiate between the degradation of physical properties due to solvency and thermal effects.

The effects of compounding variations for fluoro-elastomers is discussed, with emphasis on compounds prepared with a variety of curing agents.

10:45 a.m.—15. The Vulcanization of Butyl Rubber with Phenol Formaldehyde Derivatives. P. O. Tawney,

J. R. Little, P. Viohl, United States Rubber Co., Research Center, Wayne, N. J.

It is a well-recognized fact that during the vulcanization of butyl rubber with sulfur two competing reactions are occurring—(1) cross-linking or vulcanization and (2) reversion or devulcanization. We have found that an extremely stable cross-link is formed by vulcanizing butyl rubber with 2,6-dimethylol-4-hydrocarbylphenols or condensation polymers derived therefrom.

Butyl rubber vulcanized in a conventional fashion with sulfur plus an ultra-accelerator such as tetramethylthiuram disulfide reverts rapidly when vulcanization temperatures exceed 320° F. Butyl rubber vulcanized with the phenolic condensation polymers referred to above show no tendency to revert even though vulcanization temperatures are extended over a considerable period. The rate of vulcanization of butyl rubber by phenolic condensation polymers is slow; however, a number of catalytic agents can be used to speed up the vulcanization reaction. The amount of phenolic condensation polymer, the amount of catalyst, and the polymer unsaturation all have a bearing on state of cure.

It is estimated that the upper temperature limit of serviceability of butyl rubber may be increased by 100° F. through the use of this vulcanization system.

11:10 a.m.—16. High-Temperature Resistance of Bonded Polymer to Metal Assemblies (400-450° F.). Stewart L. Brams and Frederick W. Gage, Dayton Chemical Products Laboratories, Inc., West Alexandria, O.

The high-temperature resistance of bonded assemblies involving Viton A and butyl rubber stocks bonded to metal during vulcanization has been examined. Viton A stocks were compounded according to conventional techniques. The butyl stocks were compounded with the so-called resin cure, for high-temperature resistance of the stock itself.

The test procedure employed was an empirical test devised by the authors some years ago, which has been termed the adhesion distention test. In this test a section of rubber is bonded to two steel plates sandwich fashion, using press cure, whereupon the two plates are forced apart with screws to get some percentage elongation with sizable tension on stock and bond. The convenient assembly so produced can be subjected to all sorts of tests, and in the present work they were exposed to high temperatures in an oven, to prolonged soaking in hot fluids, and combinations thereof.

Highly adequate resistance of bond to exposures up to 96 hours at 400 and 450° F. has been observed, both in synthetic lubricants and in hot air. Correlatively, the resistance of such

stocks to these conditions while under a functional magnitude load has been confirmed.

11:30 a.m.—Business meeting. Best Paper Award to H. E. Diem, H. Tucker, and C. F. Gibbs, The B. F. Goodrich Co., Brecksville, O.; committee reports; by-law changes.

**Thursday Afternoon—May 15
Symposium on High-Temperature
Resistant Elastomers—II
Contributed Papers
E. N. Cunningham, Presiding**

2:00 p.m.—17. A New Chlorine-Containing Elastomer. L. T. Eby and J. V. Fusco, Enjay Co., Inc., Elizabeth, N. J.

A new isobutylene copolymer containing a small amount of chlorine is being established as a useful high-temperature polymer in the rubber industry. The activity of this new elastomer toward vulcanization closely resembles that of the highly unsaturated rubbers. The main chain is made up of the repeating neopentyl structure derived from isobutylene. About 1% to 2% of the monomer units are derived from isoprene and halogen, giving about 1.2% of chlorine in the polymer by weight.

The reactive allylic chloride structure provides a number of different possible vulcanization systems. Some are associated with the halogen; some with the double bond; and some with both. Because of its reactivity and polarity, this new elastomer is compatible with other elastomers such as the highly unsaturated rubbers and neoprene.

Zinc oxide alone will act as a vulcanizing agent to give cross-links with unusual stability. The addition of 0.5 to 1.0 phr. of tetramethylthiuram disulfide greatly increases cure rate and provides vulcanizates with excellent thermal stability. This system may be modified with small amounts of magnesium oxide and benzothiazyl disulfide to improve aging and scorch safety. Fast cure rates with broad cure plateau are typical for this new elastomer. Compression set, compression flexing, ozone resistance, and abrasion resistance are outstanding.

Other vulcanizing agents for this elastomer are primary diamines, quinone dioximes, and polymethylolphenols. The polymethylolphenols react similarly with this elastomer as with highly unsaturated rubbers in that the reaction is fast and direct with the polymer, without the addition of halogen containing reagents for activation.

2:25 p.m.—18. Natural Rubber Compounds for High-Temperature Service in Air. W. P. Fletcher and S. G. Fogg, British Rubber Producers' Research Association, Welwyn Garden City, Herts., England.

Demands for elastomers suitable for service at temperatures above 200° C., e.g., for military applications, have

focused attention on a number of expensive actual or hypothetical polymers. Such specialized requirements, important though they may be, should not be allowed to conceal the fact that a vastly greater volume of rubber products is needed for service at temperatures in the 100 to 125° C. range. For this region of use it is possible, by special compounding, to provide natural rubber compounds with aging properties similar to the best attainable with other general-purpose rubbers.

Two types of vulcanizing systems have been examined; first, "sulfurless" thiuram sulfide and, second, peroxide. In the former case, earlier indications of the profound protective action of the dithiocarbamate formed *in situ* has prompted an investigation into the effects upon heat aging of various added dithiocarbamates, and of dithiocarbamates formed by use of metal oxides other than zinc for cure activation. Further protection may be afforded to such vulcanizates by use of selected antioxidants, and if retention of tensile strength and extensibility are of paramount importance, an additional measure of heat aging resistance is conferred by the use of chemicals of the imidazole class. Different combinations of the various protective agents and of fillers are found to enhance different aging properties, e.g., tensile strength retention, modulus constancy, hot compression set. Thiuram sulfide curing systems convenient for vulcanization at or below 100° C. are also outstanding for heat aging and appear capable of further protection by the techniques discussed above. These offer a new order of heat resistance to products manufactured from latex.

Published data indicate that dithiocarbamates are powerful protective agents for peroxide vulcanizates in high-temperature air aging. Technological tests confirm this point for dicumyl peroxide, and by addition of the antioxidants and imidazole found advantageous for thiuram stocks, peroxide vulcanizates with excellent heat aging performance at 100 to 125° C. have been produced.

2:50 p.m.—19. Inflatable Seals for High-Temperature Service. M. A. Nadler, D. Alkire, W. A. Carr, F. J. French, North American Aviation, Inc., Downey, Calif.

Inflatable elastomer seals were used to a great extent in the Navaho missile, making it possible to employ lightweight structure for the sealing glands, thereby effecting substantial weight savings over configurations necessitating heavy flanges and bolt locks. The anticipated temperature environment in one development stage was such that pneumatically inflated silicone rubber gaskets would perform adequately. Special precautions had to be taken in the cure of the seals, however, in order to obtain sufficient reversion resistance under the confined sealing gland conditions.

Further development stages with even more severe temperature requirements led to the development of a liquid-cooled neoprene inflatable gasket with a silicone rubber sealing member. This configuration took advantage of the superior mechanical properties of neoprene rubber for the main body of the seal, utilizing the superior heat resistance of silicone rubber in the sensitive contact areas.

The paper discusses design and constructional features of the seals, considerations in selection of materials employed, curing schedules for attainment of desired properties, testing methods used to simulate service conditions for the seals, and results of such tests.

3:15 p.m.—20. Melting and Glass Transitions in Polyisobutylene. R. M. Kell, B. Bennett, P. B. Stickney, Battelle Memorial Institute, Columbus, O.

It is known that polyisobutylene and copolymers of isobutylene, such as butyl rubber, can be caused to crystallize under stress. There is, however, no conclusive evidence in the literature of crystallization in unstressed polymers of these types.

We have exposed several types of polyisobutylene and butyl rubber in dilatometers to temperatures ranging down to -60°C . for times up to 18 months. Two types of isobutylene homopolymers, Vistanex[®] L-100 and L-140, were observed to crystallize spontaneously in five to ten days at temperatures from -25 to -42°C . The maximum rate of crystallization appears to occur at about -33°C .

Samples crystallized in this temperature range and melted by slowly raising the temperature became completely amorphous at about 0°C . The observed melting point must be a fair approximation to the melting point of unstressed butyl rubber. One sample of butyl rubber, Enjay Butyl 035, became crystalline after more than one year at about -30°C ., but other butyl rubbers remained amorphous during the 1½-year exposure period.

3:35 p.m.—21. Behavior of Silicone Rubber in Sealed Systems at High Temperatures. W. J. Bobear, General Electric Co., silicone products department, Waterford, N. Y.

A study has been completed on the performance of silicone rubber in sealed systems at elevated temperatures. The principal types of commercially available silicone compounds were observed for changes in durometer, tensile strength, and elongation at 300 and 480°F .

Because of the unusual sensitivity of results to test variables, it was necessary to develop new test methods to yield reproducible results. These methods are described.

The data produced show that change

[®]Enjay Co., Inc., New York, N. Y.

in hardness alone is not a reliable measure of the performance of silicone rubber in high-temperature sealed systems. Data also point out the importance of proper choice of the basic gum, type of filler, and catalyst system. The significance of curing technique and environmental variables is indicated.

The new facts presented will permit better selection of silicone rubber stocks and will also serve as guides to their proper fabrication and application in sealed systems.

4:00 p.m.—22. Compression Set of Silicone Rubber. C. W. Roush and S. A. Braley, Dow Corning Corp., Midland, Mich.

The upper service temperature limit of seals and gaskets is often established by the compression set resistance of the sealing material. The introduction of silicone rubber extended the service temperature range, as compared to other synthetic rubbers. Continued compounding studies have resulted in further improvement in compression set resistance.

Compression set resistance is influenced by the combined effects of all ingredients in the formulation. It is the purpose of this paper to describe the effects of gum composition, fillers, vulcanizing agents, and various additives. It is shown that substitution of vinyl groups on a dimethylpolysiloxane polymer results in improved compression set resistance. Further, the proper choice of fillers and vulcanizing agents will result in lowest compression set and also shorten the oven postcure necessary to obtain the lowest compression set.

4:25 p.m.—23. Polymer Composition versus Low-Temperature Characteristics of Polysiloxane Elastomers. K. E. Polmanteer and M. J. Hunter, Dow Corning.

Low-temperature studies were performed on elastomers prepared from polysiloxane copolymers. The dimethylsiloxane content ranged from 100 down to 0 mole %. Principal attention was given to the phenylmethylsiloxane-dimethylsiloxane copolymers in determining the effect of polymer composition on low-temperature characteristics. Pendant groups other than phenyl are also discussed.

As with other copolymers, the stiffening temperature of polysiloxane elastomers was found to be dependent upon the composition of the base polymer. Stiffening of the elastomers was due to crystallization in some cases and second-order transition in others. For those siloxane polymers and copolymers that crystallized, the process was very rapid. Only one eutectic point was found in the $\text{PhMeSiO-Me}_2\text{SiO}$ copolymer system. Introducing small amounts (i.e., up to 5 mole % PhMeSiO) of bulky pendant groups in the dimethylsiloxane system showed that: (a) supercooling could be accomplished, (b) crystallization was increasingly more difficult, and

(c) the extent of crystallization was reduced.

With added amounts of the bulky side groups, a molar concentration was reached that eliminated crystallization, and low-temperature stiffening was due to nearness to the second-order transition temperature. The amount of second component needed to achieve the low-temperature eutectic point was found to be dependent upon the specific organic pendant groups used. For example, a molar concentration of 7.5% of PhMeSiO was needed.

The unique low-temperature characteristics of polysiloxane elastomers are explainable on the basis of three factors: (1) very flexible molecules, (2) low-temperature coefficient of viscosity over a broad temperature range including low temperatures, and (3) copolymerizability of dimethylsiloxane with bulky pendant group containing siloxanes which inhibit crystallization by breaking up the regularity of the building units of the molecules.

Friday Morning—May 16
Vulcanization and Reinforcement
Sheldon Nicol, Presiding

9:00 a.m.—24. Pore Sizes and Pore Size Distribution in Reinforcing Pigment Particles. Andries Voet, J. M. Huber Corp., Borger, Tex.

The presence of pores in the particles of a pigment generally influences its reinforcing characteristics in elastomers. Pores too small to allow rubber molecules to penetrate add to the surface area of pigments without contributing to reinforcement. Accelerators and other chemicals, however, could be removed from the matrix by adsorption in the pores.

The measurement of pore sizes and pore size distribution for pores of diameters above about 40 Å. has been made by means of an analysis of adsorption-desorption isotherms of gases. For pores of diameters above 70 Å. the mercury porosimeter provides reliable data.

A new approach to the measurement of pore sizes and pore size distribution has been developed for pores in the range below 40 Å., the gas adsorption isotherms of which do not show any hysteresis. The analysis is based upon the difference in nitrogen adsorption at -196°C . between porous and non-porous pigments at pressures of 0.20-0.50% of saturation. The data obtained appear consistent with practical results. Thus, EPC channel black and most furnace blacks are non-porous. MPC and HPC channel blacks are slightly porous; while oxidized color blacks have a marked porosity in the 20-40 Å. range. Pore sizes and pore size distributions of different silica pigments vary markedly.

9:25 a.m.—25. Influence of Carbon Black Type and Loading on Temperature-Retracton Properties of Elastomeric Compounds. Fred W. Barlow

and Robert W. Cretney, Thermatomic Carbon Co. Division, Commercial Solvents Corp., Sterlington, La.

Temperature-retraction relations of five commonly used blacks have been studied in smoked sheet natural rubber, neoprene, butyl, cold SBR, and butadiene-acrylonitrile copolymer. Blacks chosen were typical medium thermal, fine thermal, semi-reinforcing furnace, high abrasion furnace, and easy processing channel blacks. Loadings were 25, 50, 75, and 100 parts. Tests were conducted with the elongation being increased by 50% steps until all samples broke in the clamps. With the particular grades of polymers used, smoked sheet showed the best low-temperature-retraction properties, followed by butyl, cold SBR, neoprene, and nitrile rubber. This assessment was based on the 50% elongation results which are probably of greatest practical interest.

It was observed that lower temperature retraction values were found with the larger particle blacks such as MT and FT. Increasing the black loading raises the temperature of retraction, but the increase for the same increase in loading is much greater for the fine particle blacks like HAF than it is for coarse blacks like MT. The spread in temperature-retraction (T-R) values with loading is also influenced by the polymer used. As the test elongation is increased, crystallization increases with the crystallizable polymers. It appears that the amount of crystallization is influenced by the type of black used. Finer particle blacks induce more crystallization; HAF black is particularly effective in causing this change.

9:50 a.m.—26. Odd Electrons in Rubber Reinforcing Carbon Blacks. Gerard Kraus and R. L. Collins, Phillips Petroleum Co., Bartlesville, Okla.

The number of unpaired electrons in several rubber-reinforcing blacks has been determined by quantitative electron spin resonance assay. The odd electron concentrations are of the order of 10^{19} to 10^{20} spins/gram. These concentrations are consistent with the negative (diamagnetic) net magnetic susceptibility of the blacks.

Oxygen and other paramagnetic substances, even in extremely minute quantities, exert a powerful influence on the electron spin resonance observed. Their effect is to broaden the resonance line, and this condition reduces considerably the signal intensity. In extreme cases the intensity may be reduced to the noise level; in less severe instances the broadening may lead to erroneously low spin assays. Carbon blacks differ in their susceptibility toward line broadening effects.

Evidence is presented for a correlation between the odd electron concentration of carbon blacks and the modulus they impart to rubber, suggesting a combination reaction between the carbon black radicals and polymeric free

radicals formed during processing or vulcanization. The possibility of such a reaction is supported by electron spin resonance measurements on carbon blacks heated in the presence of rubber, both with and without curatives.

On the basis of the results available it is not possible to ascertain the full importance of the odd electrons of carbon black in elastomer reinforcement. It is certain that the unpaired electrons are not necessary for the development of reinforcement effects in general, although they may increase them substantially by providing an additional interaction mechanism for the union of black and rubber.

10:15 a.m.—27. A Theoretical Treatment of Elastomer Rupture. Laura E. Case and L. C. Case, Purdue University, Lafayette, Ind.

A new model is proposed for the prediction of rupture extensibilities of elastomers. The model consists of a "tree" or network of branched random walks. The mathematical expression corresponding to the model is a modified Gaussian distribution.

The rupture elongations of elastomers are predicted to be dependent upon the cross-link density, the functionality of the branch points, and the distribution of chain lengths between branch points. For random cross-linking, the fractional extension at rupture is predicted to be equal to

$$\sqrt{\frac{3}{21n(1+\rho)(F-2)}}$$

where ρ is the fraction of chain links that are branched, and F is the functionality of the branch points. For uniform chain distances between branches, the rupture extension is predicted to be

$$\sqrt{\frac{3}{2\rho n(F-1)}}$$

10:40 a.m.—28. Direct Determination of Combined Sulfur in Rubber Vulcanizates. W. J. Dermody, Electric Storage Battery Co., Philadelphia, Pa.

A method is described for the determination of combined sulfur in pure gum rubber vulcanizates by extracting uncombined sulfur, accelerator residues, and other extraneous organic materials using a binary azeotrope of benzol and methanol, oxidizing the polymer residue with nitric acid and potassium chlorate, and determining sulfur gravimetrically as barium sulfate.

Extraction efficiency of the recommended azeotrope is exemplified and compared to acetone and aqueous sodium sulfite. Possibilities for error due to volatile loss during extraction, over-extraction of combined polysulfide sulfur, or retention of solvent in the specimen or extract after extraction and drying are discussed.

Superiority of direct determination to indirect computation based on separate determinations of free and total sulfur

is claimed, and precision of the recommended method assessed.

A new term, *polymer linked sulfur*, is introduced to identify a parameter which will adequately characterize the properties of vulcanizates in terms of a combined sulfur value independent of extraneous materials in the mixture and directly determinable by analysis of the vulcanizate.

11:05 a.m.—29. The Temperature Coefficient of Vulcanization of Butyl Rubber (Effect of Accelerator System and Polymer Unsaturation). J. G. Martin² and R. F. Neu, Enjay Laboratories, Linden, N. J.

This paper is a study of the effect of the accelerator system, degree of polymeric unsaturation, as well as the method of cross-linking on the temperature coefficient of vulcanization (TC) of butyl rubber. This temperature coefficient is a measure of the dependency of the rate of determining reaction of vulcanization upon the cure temperature. This study uses two different methods based on simple laboratory techniques in determining a value of TC for butyl of 1.37 for a change in curing temperature of 10° F. It shows further that the coefficient is independent of the unsaturation level of the various grades of butyl, and that except for certain dialkyl dithiocarbamates, it is independent of the accelerator system used. This last statement is in contrast with the 32% difference in the coefficient for natural rubber for a variety of its accelerators. The data used in this study show certain trends in the reversion of butyl cures, and these are recorded as a reference source for future work.

Use of these temperature coefficient and reversion data, together with previously published information on the thermal diffusivity of butyl compounds, permits the choice of proper curing times and temperatures for an article of any given size and shape.

11:30 a.m.—30. Vulcanization of Elastomers by Electron Beam Irradiation. H. A. Winkelmann, Dryden Rubber Division, Sheller Mfg. Corp., Chicago, Ill.

Vulcanization of natural rubber, SBR, neoprene, nitrile rubber, and polyurethanes by irradiation with beta rays, using a 1 MEV electron beam generator, is an important advance in rubber technology. When properly compounded, these elastomers can be cured at room temperature to give good vulcanizates in 10 to 30 seconds. Beta rays have a high intensity, but low penetration. The optimum thickness of the rubber compound for beta-ray curing using a 1 MEV generator is 1/10- to 1/8-inch.

Irradiation of uncompounded natural rubber and SBR deteriorates the polymers, owing to scission, resulting in a

²Present address: Princeton University, Princeton, N. J.

tacky uncured product. Neoprene and nitrile rubber, when irradiated alone, give a poor cure that is dry.

Reinforcing carbon blacks are the only fillers that give good physical properties with these elastomers. It is not necessary to use sulfur, accelerator, etc., to obtain good cures with natural rubber, SBR, or nitrile rubber. Neoprene may be cured without magnesium oxide or zinc oxide. Mineral fillers and other compounding ingredients in all elastomers give low tensile strength as well as a tacky surface and porosity. Neoprene and nitrile rubber show less tackiness than natural rubber or SBR. Good cures can be obtained by adding mineral fillers to a compound containing reinforcing carbon blacks. The elongation of beta-ray cured elastomers shows a tendency to decrease rapidly with increase in dosage. This difficulty can be overcome by using extenders such as cumars, petroleum hydrocarbons, and mineral rubber.

Sulfur will combine, at room temperature, with natural rubber by irradiation with beta rays. Oil resistance of elastomers is generally improved.

Outdoor exposure tests show that some compositions of natural rubber and neoprene, cured with beta rays, have not cracked after 870 to 900 days.

11:50 a.m.—31. Chemical Loaded Molecular Sieves as Latent Curing Aids —I. Secondary Accelerators in Styrene-Butadiene Rubber. F. M. O'Connor, T. L. Thomas, Linde Co. Division, Union Carbide Corp.; M. L. Dunham, Silicones Division, Union Carbide

Corp., both at Tonawanda, New York.

Rapid curing rubber and thermosetting plastics formulations that have good processing and storage characteristics are of considerable interest to compounders. A novel product which imparts properties of rapid cure and safe processing has been developed. The combination of a Linde molecular sieve and an active compound, held within the structure of the molecular sieve by adsorptive forces, produces a unique temperature-sensitive curing aid. The active compound is isolated from the system during the processing and storage steps, but is released from the molecular sieve at the elevated vulcanization or curing temperature to function in its normal manner. Very active compounds can be used to obtain fast cure rates without sacrificing processing safety or pot life.

This technique is being used commercially in the vulcanization of silicone elastomers with di-tertiary butyl peroxide. Extensive laboratory investigations have shown that this principle can also be applied in the curing of a variety of organic rubber and plastics formulations, including styrene-butadiene rubber, natural rubber, neoprene, epoxy resins, and rigid vinyl plastisols.

This paper presents data to illustrate the latent curing aid principle and describes the use of amine loaded molecular sieves as secondary accelerators in styrene-butadiene rubber. Amine loaded molecular sieves are latent secondary accelerators for thiazole-type primary accelerators, either alone or in combination with conventional secondary accelerators.

urer's report was read for Wm. King, Acushnet Process Co., by G. Herbert, Tyler Rubber Co., executive board member. J. M. Hussey, Goodyear Tire & Rubber Co., spoke about Chemical Progress Week, and the need of more speakers to cover the schools and service clubs wishing to hear about chemistry.

C. S. Frary, Jr., Boston Woven Hose & Rubber Co. Division, American Biltrite Rubber Co., education committee chairman, and new executive board member, reported on the two educational courses run by the group with Northeastern University this year, with 34 having graduated from the Elements I course, and 41 now registered with the Principles II course. C. Griffith, Q. M. Res. and Eng. Command, instructor. A total of 365 has either completed the educational courses over the past four years, or is presently enrolled in the Principles II course.

The after-dinner speaker was N. D. Hoyt, St. George's School, Newport, R. I., who spoke on "The 1957 Race to Spain (Sailboats) and Attendant Disasters," illustrating his talk with colored slides and complete descriptions.

The next meeting of the Group will be the summer outing at the Andover Country Club, Andover, Mass., June 13.

Materials Handling For ASME Conference

Materials handling problems in the atomic and space age will be among the topics featured during the Materials Handling Conference at the Public Auditorium, Cleveland, O., June 9-12, it was announced recently by James N. Landis, president, American Society of Mechanical Engineers, sponsor of the Conference.

The Conference will be held concurrently with the National Materials Handling Exposition, produced by Clapp & Poliak, Inc., New York exposition management firm. The show, a broad comprehensive exhibit of every kind of mechanical handling equipment, will include more than 100 basic types of machines.

The session devoted to handling in the atom-space age will feature papers on the handling of radioactive materials, ground handling and launching problems of space ships, and special ground support equipment for handling rockets and missiles.

The urgent need of cost reduction in the nation's factories and distribution systems will be the focus of attention in the remaining sessions. Topics for these meetings will stress the profits squeeze, resulting from increased costs and lowered prices, which appears in prospect for the economy.

Silicone Symposium for Boston Rubber Group

The spring meeting of the Boston Rubber Group, held March 21 at the Hotel Somerset, Boston, Mass., featured an afternoon symposium on "Silicone Rubber," chairmanned by James C. Walton, Chase-Walton Elastomers, Inc., and attended by 80 members. This meeting was held during the worst snowstorm ever recorded for this time of the year.

Mr. Walton introduced the following speakers and their subjects: D. P. Spaulding, General Electric Co., who dealt with "Special-Purpose Compounding of Silicone Elastomers"; B. B. White, G-E, who discussed "Four Years of Progress in Silicone Rubber"; and J. H. Lorenz, Union Carbide & Carbon Co., who spoke on "The Future of Silicone Elastomers."

Dr. Spaulding first outlined the present-day compounding methods used with silicone gums, indicating the fillers and the curing agents used with them, their chemical composition, and the properties that might be secured with each. He then considered

three specific compounding cases. A question period followed his talk.

Mr. White contrasted conditions in the field of silicone rubber chemistry and utilization now and four years ago, when he had first addressed this group on silicones. He pointed out that now 19 more gums are available, from three times as many suppliers, and that there were 22 more specifications and four new ASTM grades of these elastomers. He listed the improved properties of these compounds and reviewed new product applications.

Mr. Lorenz said the elastomer field was the fastest-growing field in silicones today. Improvements could be expected in high-temperature resistance, in bonding, and in solvent resistance. His talk was divided into processing methods and special processes such as sponge and conductive stocks.

The dinner attracted 260 members and guests. After the meal R. Steller, The B. F. Goodrich Co., Boston Rubber Group chairman, presided over a short meeting, during which the treas-

Philadelphia Group Panel on Textiles

The Philadelphia Rubber Group meeting held a meeting on January 24, at which a panel discussion on "The Use of Textiles in the Rubber Industry" was featured. Members of the panel and the moderator, shown in the accompanying photograph, consisted of E. L. Borg, Naugatuck Chemical Division, United States Rubber Co.; D. H. Heckert, E. I. du Pont de Nemours & Co., Inc.; F. J. Kovac, Goodyear Tire & Rubber Co.; C. H. Schroeder, The B. F. Goodrich Co.; H. R. Schwarz, Wellington Sears Co.; with B. S. Garvey, Jr., Pennsalt Chemicals Corp., as moderator.

"Inter-Industry Cooperation Leads to Better Times," was the subject of the talk by Mr. Heckert in which he first pointed out that Du Pont has been particularly active in pioneering the development of synthetic fibers for reinforcing rubber industry products. In the early 1930's, research was begun to develop an acceptable rayon reinforcing yarn for rubber products. Cordura type rayon tire yarns were in use before 1940, Super Cordura in 1953, and Type 272 Super Cordura in 1955. In 1940 the first nylon tire yarns were offered, and Du Pont worked with the industry to develop nylon tires for the Armed Forces for uses where neither rayon nor cotton cord tires were satisfactory. In the early 1950's, Dacron polyester fiber was introduced to the industry as a reinforcing material for industrial rubber products, and each new or improved yarn has led to the production and sale of rubber products with improved cost and performance.

Du Pont now has an industrial textile products research laboratory where leads for the solution of industry-wide problems, which leads can be used as a basis for further research activity by the consuming industry, are developed. The Du Pont laboratory can thoroughly

characterize new or improved yarns, determine their future potential, and eliminate new yarns with only limited commercial application.

In the early 1950's, laboratory and fleet testing of commercially produced nylon and rayon tires, and experimental tires made under controlled conditions in the Du Pont laboratory, led the company to believe that nylon would eventually become the leading tire cord yarn because it produces a safer and more durable tire. These data were discussed with the tire companies who agreed with the basic conclusions. Du Pont then planned and is now installing additional nylon capacity to be ready for increased demand. Meanwhile new market studies were made with the hope of locating new uses for Super Cordura rayon.

As evidence of the penetration of nylon into the tire market, Mr. Heckert said the tire industry in 1953 used approximately 430 million pounds of rayon and less than 15 million pounds of nylon for tires other than airplane which are made 100% with nylon. In 1957, only 312 million pounds of rayon tire cord were sold; while nylon accounted for 35% of the 1957 potential market.

This increased use of nylon has resulted from technical developments by the tire industry, equipment manufacturers, and the Du Pont company. At present, essentially all airplane, heavy duty, on- and off-the-road truck tires are made with nylon, as are all the premium and 35% of the first-line replacement passenger-car tires. Nylon has also made a substantial penetration in the medium and light-duty truck and bus tire markets and in the second-line passenger-car tire market, it was said.

This increased nylon cord usage has been made even though the full potential of nylon tire cord has not been realized. Improved hot stretching tech-

niques coupled with post inflation are solving the problem of nylon tire growth, and a reduction of nylon content and therefore of cost is possible. The mechanics of flat spotting have been defined, and an increase in cord modulus, which can be accomplished through proper hot stretching and post inflation, will reduce flat spotting. Changes in tire design and in the elastomers used will further reduce flat spotting and will also reduce the noise level experienced with nylon tires, Mr. Heckert said in conclusion.

"Tire Cord" was discussed by Mr. Kovac, who said that many of the big improvements in tire performance have stemmed from better tire cords. The super performance of tires today resulted from developments made stepwise to keep pace with the service demands of heavier trucks and automobiles.

Tire cord is the reinforcing member of the tire and gives the tire its shape, size stability, bruise resistance, fatigue resistance, load-carrying capacity, and heat resistance. Tire cord is the most costly part of the tire.

Mr. Kovac then related developments in connection with the various types of tire cord over the years.

Cotton

The first pneumatic passenger-car tire was built about 1900 and was reinforced with *square-woven cotton* fabric. This-type tire at best ran 1,500 miles, but more often failed at 100 miles.

Square-woven cotton fabric was replaced about 1920 with *cotton cord*, and the use of plies of this cord added tremendous durability and resiliency to the tire.

Rayon

Rayon tire cord was used experimentally in the 1930's, but it was not until the 1940's that synthetic rubber began to replace natural rubber, and the synthetic fiber, rayon, began to



Jules Schick, Photography

Philadelphia Rubber Group "Textiles in the Rubber Industry" panel members; D. H. Heckert (place card not visible) is the man on the extreme left

replace the natural fiber, cotton. Rayon opened up a whole new field in tire cord technology since it could be modified and improved up to the limits of the fiber as service requirements changed. Various rayon cords were tested in tires, and the industry finally standardized on 1650/2 denier cord.

Military equipment throughout the world used rayon cord tires in World War II, and after the war, rayon expanded into civilian use and performed well for years. Tires built from rayon were cooler running and gave longer mileage, increased safety, and greater economy than did cotton. Service conditions soon became too severe for existing rayon cords, and in 1953 a new rayon cord called super rayon, which exhibited a 25% improvement in strength and fatigue resistance over the previous rayon cords, appeared on the scene. These super rayons boosted tire performance and made substantial contributions to tire technology.

Nylon

During the late stages of World War II the Armed Forces developed the need of a tire cord with super bruise resistance, high fatigue resistance, and good moisture and heat resistance which was satisfied by nylon tire cord.

Goodyear was the first tire company to introduce nylon cord tires on a commercial basis in 1947.

Nylon cord makes excellent tires because of its impact strength, fatigue, and moisture resistance and because such tires have sales appeal and very good performance at high speeds. Pound for pound nylon is stronger than steel, and it has an amazing ability to adapt to extremely severe service conditions without failure. Nylon is more like the rubber tire compound in modulus, and there are less shear forces between the tire components. The thermal shrinkage characteristics of nylon are believed to be a factor in providing for its superior performance in tires run at high speeds since the hotter the tire becomes, the more the nylon cord shrinks, thus helping to hold the tire together.

Nylon has excellent abrasion resistance, compressibility, elasticity, and recovery, and these properties all contribute to the resistance to fatigue failure. Nylon has equivalent strength wet or dry.

As attractive as nylon is for use in tires, there are improvements needed. Nylon tires cost more than rayon tires except in the large sizes; tire growth is greater with nylon than with rayon, and the chief method of stabilizing nylon to elongation under load (or growth) is an elaborate hot stretching treatment. Nylon tires are rated poorer than rayon for ride quality and noise. Finally, although thermal shrinkage of the cord is an advantage in tires, the lack of control of thermal shrinkage poses a serious processing problem.

In summary, nylon tire cord has

better shock, moisture, and fatigue resistance; provides for better high-speed tire performance and sales appeal than rayon. In contrast, rayon tire cord provides tires at a lower cost, with less growth; it processes better, and such tires have better esthetics (ride quality and noise level).

The larger the tire size, the more economical the use of nylon cord. At present, nylon cord is used exclusively in airplane, off-the-road, racing, military, special turnpike and police cars, and premium passenger-car and truck tires. Rayon cord continues to be used in the 100-level passenger-car and truck tires, and constant improvements are being made in this type of tire cord. Improvements in both types of cord will be to the ultimate benefit of the tire users since the tire companies in their choice of cord will aim for the lowest cost per mile performance for the tire user.

Wire

Steel wire cord seems to be gaining in importance, and new ways to handle wire cord in tires are being developed. Wire cord has the advantages of being practically indestructible, dimensionally stable, heat resistant, and provides cool running tires which give very good performance at sustained high speeds and loads and give phenomenal tread wear. Disadvantages have been high cost, separation of tire plies, and low fatigue resistance.

The development of the X or radial ply construction with wire cord has created a new interest in this-type cord.

Aluminum

Aluminum wire cord would have a definite weight advantage over steel. The chief shortcomings in the past have been very poor fatigue resistance and low adhesion to rubber. Considerably more development work will be devoted to aluminum tire cord.

Dacron

In many ways Dacron appears to be intermediate in properties between rayon and nylon. Tires made from Dacron show little or no growth even though it is a thermoplastic material like nylon. Chief disadvantages of Dacron are poor adhesion, poor high-temperature fatigue properties, and lower strength than nylon.

Asbestos

Although asbestos is not usually considered for tire cord use, its fibers can be spun into cords in the same manner as cotton. The stability and heat resistance of asbestos are excellent, but many problems remain to be solved before asbestos fibers become significant in the tire cord field.

Glass Fiber

Glass fiber has been used with limited success in special-purpose tires,

and such tires have the advantages of high strength, excellent dimensional stability, cool running, and excellent heat resistance. Glass fiber, however, has the serious disadvantages of high cost, poor fatigue resistance and adhesion.

Cord of Tomorrow

Mr. Kovac concluded by outlining the properties of the premium tire cord of the future. Such a cord should have maximum bruise resistance which involves modulus, elongation at break, and gage of the cord. It should provide a tire with very good tread wear, which is related to deformation of the tire cord under load, and the tire should therefore be dimensionally stable with little or no growth. The cord should be designed to operate with one or more synthetic rubbers as an integral chemical and physical unit; it should be able to retain its properties at temperatures as high as 500°F., and the fatigue resistance must be at least better than that of rayon.

"Latex Tire Cord Adhesives," by Mr. Borg was published in our February, 1958, issue on page 723, and therefore will not be repeated here.

"Textiles in Industrial Products Applications," by Mr. Schroeder, began by emphasizing the cooperative effort between textile producers and rubber goods manufacturers during the past 90 years. The textile industry has designed special materials which have made improvements in rubber products possible, while advances in elastomer technology challenge the textile industry to still further developments.

Textiles are used in hose and belting as tension members to absorb and distribute stress encountered in service. In a hose the tension member must withstand the stress or the lack thereof, and the movement in service. In belting, the tension member carries the load, absorbs the shocks, and/or transmits power.

In the first 70 years of the history of industrial rubber products, cotton was the principal textile fiber and was supplemented with minor quantities of linen, asbestos, and other fibrous materials. Special yarns and cords were introduced, and improvements made in the designs of woven fabrics for hose and belting. Braiders, circular looms, and knitters were designed for applying yarns and cords to the manufacture of hose. Wire was introduced in high-pressure hose and high-tension belting to extend the operating limits of these products.

In recent years other textile fibers have become available, such as rayon, nylon, Dacron,¹ Fiberglas,² and Forti-

¹E. I. du Pont de Nemours & Co. trade mark for polyester fiber.

²Owens-Corning Fiberglas Corp. trade mark.

san.² These new fibers have done as much to broaden the horizons for design engineers as the advent of styrene-butadiene, nitrile, butyl, and neoprene synthetic rubbers.

The use of these new synthetic fibers has made possible a weight reduction of 30-35% in fire hose, with no loss of burst strength.

Conveyor belts made with "industry standard" type of cotton ducks were limited to about 75 lb./in./ply. Now we have nearly tripled operating tensions by using synthetic fibers, and the belts are flexible enough to trough well, Mr. Schroeder explained.

No one fiber appears to be the best for all types of industrial rubber products. Each fiber has a different balance of properties, and each rubber product demands a different combination of characteristics. In fact, similar products may not require the same balance of properties from the fiber. For example, in V-belts, four different fibers, nylon, rayon, Dacron, and Fortisan-36, are used in commercial quantities.

When a design engineer is called upon to select a fiber for a textile used in an industrial rubber product, he must consider tensile strength, definite elongation, resistance to flex fatigue, high ratio of shear to tensile strength, dimensional stability under a wide variety of temperatures and humidities, minimum change in tensile strength under different conditions of temperature and moisture, adhesion to rubber, good age resistance, freedom from growth under load, and flame resistance.

Mr. Schroeder concluded by saying that although great progress has been made in the past by both the textile and rubber products industries, the future is even brighter. Both industries will be busy keeping up with the advances made by the other.

"The Use of Textiles in the Rubber Industry" was the title of the talk by Mr. Schwarz. Industrial textiles for the rubber trade cover an extensive range of fabric and cord constructions made from both natural and synthetic fibers, he said and then went on to describe the various fibers and fabrics used.

Cotton

Low in cost and available in ample supply, cotton was the first fiber used by the rubber industry, and it provided good all-around physical and chemical properties. The fiber's natural twist enables the spinning of strong yarns and is an important factor in the mechanism of bonding to rubber. Cotton is durable, absorbent, stretch resistant, and possesses excellent dimensional stability. It bulks and insulates well and has high wet strength. It has poor acid resistance, but displays good resistance to alkalis and solvents.

²Celanese Corp. of America trade mark.

Rayon

The higher strength-weight ratio of high-tenacity filament rayon fabrics enabled the tire manufacturer to make thinner plies which would withstand more heat and greater loads. With the advent of the tubeless tire, rayon chafers have also become well established. Rayon yarns are being used in ever-increasing volume in mechanical rubber goods such as conveyor and transmission belting and in hose and diaphragms.

Filament rayon fabrics of higher strength-weight ratio resulted in a trend toward lighter weight and thinner materials and necessitated many changes in equipment on the part of the cotton goods manufacturer, which involved yarn preparatory machinery as well as modifications in weaving facilities.

Nylon and Dacron

Nylon, with its outstanding mechanical characteristics, is already well established and growing in tire cord structures and is finding increasing usage in the conveyor belt field, Mr. Schwarz said. Nylon is employed as the filling member of cotton or rayon warp belting constructions, enabling the rubber goods manufacturer to make thinner belts with improved physical characteristics.

Through the advancement of manufacturing techniques, filament nylon is also being used in increasing volume for tarpaulins and many other types of coverings where cotton ducks played such an important role in the past. Lightweight fabrics, ranging in weight from 2½-5 ounces per square yard, are neoprene or vinyl coated on both sides and are replacing cotton ducks weighing, before waterproofing treatment, as high as 18 ounces per square yard.

Dacron, with good acid and heat resistance, relatively low stretch as well as high strength and abrasion resistance, is another synthetic fiber which shows great promise for use by the rubber industry.

Fiber Forms

Fibers, both natural and synthetic, are available as staple, such as short fibers of cotton and wool, and filament yarns such as the long strands of rayon. Synthetic fibers may be used singly as monofilament yarns or twisted together to form multifilament yarns. They may also be cut into staple fibers or predetermined lengths for spinning into yarns on the conventional cotton system.

It was pointed out that filament yarns made from synthetic fibers, as well as certain spun-type yarns, may also be subjected to hot stretching and heat-stabilizing operations to improve their strength and elongation characteristics. Except for tire cords, yarns of this type have found few applications in the industrial field, chiefly,

however, because of economic considerations. Synthetic multifilament yarns can also be made to simulate spun yarns by forming loops in the individual filaments during a twisting process or by other twisting techniques.

In the case of spun yarns, staple fibers are ordinarily opened, paralleled, attenuated, and finally twisted into yarn by the spinning process. Spun yarns for industrial purposes, including the majority for rubberized applications, are generally carded, but the higher-cost combed yarns may be specified in some instances for certain fine yarn, high-count fabric constructions.

Both fiber properties and the frictional hold of the fibers to themselves have a direct bearing on yarn breaking strength. Spun yarns, whether they are made from cotton or rayon or nylon, provide bulk and also flexibility, since the individual fibers can shift within the yarn structure when subjected to flexing or some other form of distortion. Spun yarns, furthermore, have excellent absorption characteristics and adhere mechanically to other materials such as rubbers.

Staple fibers of various types may also be blended to obtain yarns with improved properties. For example, abrasion resistance can be substantially increased by blending nylon staple with cotton prior to the spinning operation.

Filament yarns, on the other hand, have greater breaking strength in relation to weight than spun yarns. Although filament yarns do not adhere so well to rubber, adequate adhesion can be obtained by predipping the cord or fabric prior to rubberizing with a resorcinol-formaldehyde latex.

It is possible to combine yarns of different types; for example, a spun yarn may be twisted with a filament yarn, or a fabric may be woven with a filament warp and a spun filling, or *vice versa*. Also, yarns of both basic types may be twisted together for greater strength into plied yarns, which, in turn, can be twisted, usually in the opposite direction, into cabled yarns.

Yarns spun on the cotton system are designated by the number of 840 yarns or hanks per pound. Filament yarn sizes are also designated on a weight basis, but follow the old silk system of measurement. The term "denier" is the number of grams per 9,000-meter length. Monofilament yarns, such as nylon or polyethylene, are generally measured on a diameter basis rather than a weight basis; the mil is the unit of length measurement used.

Fabric Construction

After fiber and yarn, the next element in fabric construction is the weave, which is the system of interlacing the lengthwise warp yarns called "ends" with the crosswise filling yarns known as "picks." There are only the three basic weaves: namely, plain, twill, and

satín. There are, however, many variations of these basic weaves. In the basket weave, two or more yarns in both the warp and the filling are woven as one, providing higher tear strength. The rip-stop weave is a further variation of the basket weave, providing basket-weave "stops" at regular intervals in both warp and filling of an otherwise plain-weave fabric. This basket-weave principle is used in the manufacture of coating fabrics from low twist multifilament nylon yarns in which the individual filaments lie flat and ribbon-like.

The leno weave, another variation of the plain weave, is an open-mesh construction with the warp yarns alternately twisted in a right-and-left handed direction so as to cross between each pick, thereby greatly reducing yarn slippage. A comparatively recent textile development is the use of lightweight, open-mesh, plain-weave filament yarn constructions for abrasive grit cloth, vinyl laminating, paper reinforcement, and reinforcement of foam rubber products. To minimize weave distortion during shipment and subsequent handling, it is necessary to treat this fabric with a bonding agent at the mill level.

In addition to woven materials, knitted constructions are available for the coating trade. These fabrics provide a high degree of elasticity and possess the ability to return to their original shape after distortion. So-called non-woven or bonded fabrics are growing in importance for industrial purposes. At present, random fiber webs having approximately equal strength "around the clock" are being used for vinyl backing, bags, imitation felts, and shoe components. Synthetic rubbers and resins are employed as fiber bonding agents in the production of non-woven fabrics manufactured from various fibers.

Industrial textiles are often used in the "grey" or unfinished state as they come from the loom. Scouring may be necessary to remove extraneous oils, waxes, or warp sizing materials. Other common fabric finishing processes include calendering, to produce smoother surface and thinner gage, and napping, to raise flannel-like pile on one or both sides of spun or filament fabrics. In the case of nylon and Dacron, heat-setting may be specified for improved dimensional stability, an important consideration in the case of rubberized products such as aircraft fuel cells, radomes, and other special fabricated forms.

Pretreated Fabrics

The cotton textile manufacturers who have traditionally supplied the rubber industry with cords and fabrics for reinforcement, as well as for supply items, such as liners, cure wraps, and leaders, have found it necessary radically to change their processes in or-

der to provide suitable fabrics from the various synthetic fibers. These manufacturers are now faced with new problems in supplying fabrics pretreated for adhesion to rubber. The role of the textile manufacturer in providing this service is growing in importance, particularly as new and improved treatments become available.

Through the continued cooperative efforts on the part of the fiber producers and the textile manufacturers, even greater improvements in industrial fabrics for the rubber industry should and can be made.

Questions and Answers

Q. We have seen a limited amount of data indicating that advantages are obtained in industrial fabrics for many applications by preparing blends of different types. For example, a blend of 40% Dacron with 60% cotton may triple the abrasion resistance of fire hose. Is extensive development work being conducted on such fiber blends?

A. Schwarz. Cotton-nylon and cotton-Dacron blends have been evaluated for rubber footwear applications. Improved abrasion resistance has been realized, but little in any yardage is being supplied because of economic considerations. Work is also being done with cotton-nylon blends using Du Pont's new-type 420 nylon staple for V-belt covers.

Q. Is there any method of hot stretching and heat setting Dacron yarn to reduce the ultimate elongation and make the fiber dimensionally heat stable? Are there any commercial processors using this method, if available, at present?

A. Heckert. Improvements in the stability of Dacron cords can be obtained through single or multistep hot stretching. Bibb Mfg. Co., Macon, Ga., and Deering, Milliken, Inc., New York, N. Y., are hot stretching Dacron cord on a commercial basis.

Q. How many times can a 9.00 by 20 rayon truck tire be recapped for satisfactory fleet service, as compared with the same-size tire made with nylon cord?

A. Kovac. Satisfactory recapping of tires is dependent on many factors such as the type of maintenance they have had, severity of service conditions, etc. It would probably be safe to say that a 9.00 by 20 rayon truck tire might be recapped 2-3 times, as compared with 4-5 times for a nylon truck tire of the same size.

Q. What is the growth percentage in the same-size truck tire made from nylon and rayon after 10,000 miles?

A. Kovac. Actually the service growth in a truck tire is completed in 5,000 miles. Typical data comparing rayon and nylon service growth show the nylon to be higher, but the growth differ-

ence is comparatively small, 1-2%, and both tires should give good tread wear.

Q. What is the bursting strength of 9.00 by 20 rayon and nylon tires with the same number of plies?

A. Kovac. A nylon truck tire will test about 50% stronger than a similar rayon tire for plunger energy based on static penetration bruise tests. On dynamic tests the nylon shows up even stronger.

Q. What is the weight of a 9.00 by 20 rayon tire compared with a nylon tire?

A. Kovac. A rayon truck tire of this size will weigh about 91.5 pounds, and a nylon truck tire about 85 pounds, or 7% less.

Q. Rayon of 1650 denier is used for passenger-car tires and of 2200 denier for truck tires. Are there separate rayon deniers used for passenger and truck tires, and, if so, what are they?

A. Kovac. Practically all of today's rayon tires are made from 1650/2 cord. At one time off-the-road tires were made with 2200/2 rayon, but most of these tires are made from nylon today.

Nearly all nylon tires are made from an 840/2 cord at the present time. Considerable development work is under way by the tire companies, with larger nylon cords, such as 1680, and with cords two, three, four, or more times larger than the present 840/2 cord.

Q. On a run from Texas to Los Angeles, using the same size tire, what is the average miles per tire for rayon vs. nylon, and what is the average running temperature of each tire?

A. Kovac. Rayon will show about the same wear as nylon if all variables are equal and speed laws are observed on such runs through the Southwest. Nylon tires are sometimes poorer than rayon in wear, though usually not more than 5%. Nylon tire wear will vary, depending on the way in which the manufacturer has treated the nylon and built and cured the tire. If the car is driven at 100 mph. or more, a higher incidence of premature failures with rayon tires would be expected.

Tire temperatures will vary widely, depending on the type of tire, tread compound, tire construction, inflation pressure, speed, etc., but in general nylon tires will run about 10-20° cooler than rayon tires.

Q. What is the difference in hours or days of service between the same size V-belt made of rayon or nylon in a laboratory test?

A. Schroeder. It is possible to test a nylon belt under conditions where it will fail more quickly than an equivalent rayon belt, or test conditions can be selected whereby a nylon belt may outlast a rayon belt by a

factor of ten. In general, on free center tests, nylon belts show greater superiority than on fixed center-type tests.

Q. What is the average temperature used to hot stretch nylon?

A. Heckert. The temperature in hot stretching nylon cords ranges from 380 to 450° F.

Q. What are the requirements of the "duck" or other type of textile used for conveyor belts and hose?

A. Schwarz. Common weights of standard cotton belt ducks are 28, 30, 35, and 42 ounces calculated on a 42-inch width basis. They are relatively coarsely woven plied yarn constructions with the weight and strength predominating in the warpwise direction. There has been an increasing trend, however, toward the substitution of filament nylon or rayon for the cotton filling. These fabrics are generally made to customer specifications, which include breaking strength, elongation, crimp, and gage, as well as construction requirements. High-tenacity filament rayon is used in the warp, and filament nylon generally specified for the filling in fabric for high tensile conveyor belts.

Coarsely woven plied cotton yarn fabrics with an approximately equal distribution of weight and strength in warp and filling are used for wrapped hose. Filament yarn fabrics are used for certain applications, and there is an increasing interest in hose ducks made from semi-high tenacity rayon staple. These latter fabrics have a higher strength-weight ratio than cotton fabrics and a higher gage, more comparable to that of the equivalent cotton fabrics, than the filament yarn constructions.

Q. Does the use of a textile for a heat-resistant rubber covered product require a certain fabric?

A. Schroeder. In general, no specific fabric is required for use in heat-resistant rubber covered products. Excellent products can be made using heat-resistant rubber compounds in conjunction with cotton, rayon, Dacron, Fiberglas, asbestos, and wire fabrics. The elastomer often protects the textile component and permits it to operate at higher temperatures than would be predicted from aging the fabric alone. It is difficult, therefore, to establish temperature limits for various fibers.

Q. What coatings, if any, are used to improve adhesion of rubber to fabric?

A. Borg. In some instances a tie coat may be used to increase the adhesion of rubber to fabric, and the nature of this tie coat would be determined from the nature of the fabric and the rubber. Generally, a rubber tie coat similar to the rubber stock itself, and applied by calendering, or as a latex, or from solvent is adequate. In difficult cases it may be necessary to use a tie coat containing special functional groups for

the same reasons that these materials are now quite generally used in the pretreatment of tire cords.

Q. Does it appear that synthetic fibers such as nylon or Fiberglas will ultimately replace natural fibers in such products as hose, wire and cable, and belting?

A. Schroeder. Natural fibers will continue to be used as long as their balance of properties most closely meets the requirements of the end-product. In the future, we expect there will be a whole spectrum of fibers having different combinations of properties, and natural fibers will be there contributing their special characteristics.

Q. Is the ultimate tire cord to be a blend of nylon and rayon, as regards price and service?

A. Kovac. I doubt that a blend of rayon and nylon will ever make a good tire cord, since such blends have shown the two to be incompatible. Blends of rayon and nylon possess the poorer fatigue of rayon and the higher growth characteristics of nylon. Since the moduli of nylon and rayon are so far apart, they will not share the load in the tire.

Q. What is the future of non-woven fabric in the rubber industry?

A. Schwarz. Although non-woven fabrics have found a definite place in the vinyl coating industry, work with the rubber industry is in the experimental stage at the present time.

Q. What are the prospects for new fibers which will be of interest to the rubber industry?

A. Heckert. Du Pont produces on the average 1,500 new experimental polymers a year, and others are also making large numbers of new polymers. It is only reasonable to believe that this work will lead to the development of new fibers which will replace those currently being used.

Q. What is the latest thinking on obtaining improved properties by hot stretching nylon tire cord?

A. Heckert. Studies on the hot stretching of nylon tire cord by Du Pont and the tire industry have shown that improved strength, reduced growth, and higher yields resulting from improved hot stretching conditions, including multi-step hot stretching, are carried over into the tire, and that the tire has better growth and flat spotting characteristics as well as economics.

Q. What is the difference between creel and beam weaving?

A. Schwarz. In creel weaving the warp yarns are fed directly to the loom from small individual packages or spools mounted on a creel or rack set behind the loom. Such weaving is well adapted to short warps, very coarse yarn numbers, and when warp tensions are not critical. Beam weaving is the conven-

tional system of weaving in which warps are put up on beams from high-speed warpers prior to weaving.

Q. How can nylon adhesion to various polymers be improved?

A. Borg. Nylon, a smooth, polar fiber, bonds tightly to polymers containing polar functional groups. A pretreatment of nylon with a tie coat polymer containing 2-vinyl pyridine, for example, should give adequate adhesion to practically all other polymers.

Q. Explain why nylon tires roar.

A. Heckert. All tires make noise as they are driven down the highway. Tread design, elastomer type, road surface, speed, and type of reinforcing material all have an effect on the noise produced.

In tests conducted at Cornell University on tires that differed only in type of cord reinforcement, the noise level for nylon cord tires was found to be seven to eight decibels higher than in the 400 to 800 cycles per second range. Above this range, nylon and rayon tires produced noise at about the same level. This test was conducted at 35 miles per hour, while the car was coasting, and with a microphone placed about eight inches from the tire and five inches above the road.

Q. What happens when nylon tires flat spot? What laboratory test can be correlated with flat spotting?

A. Heckert. We installed stress-strain gages in the shoulder areas of both nylon and rayon tires to record the changes that take place during the formation of flat spots. The inflated nylon tire was shown to be under tension in both the radial and circumferential directions; while the inflated rayon tire showed a smaller tensile strain in the radial direction and a small compressive strain in the circumferential direction, the differences were minor. When the tires were loaded, both the nylon and the rayon tire showed compressive strains in the radial direction and tensile strains in the circumferential direction.

After standing under load for 18 hours, the nylon tire showed a tensile strain in both radial and circumferential directions; whereas when it was first loaded, it was under compressive strain in the radial direction and tensile strain in the circumferential direction. The rayon tire continues to fight the deformation and maintains a compressive strain radially and a tensile strain circumferentially. When we unload the tires, the rayon tire tends to pop out the flat spots and lose a good share of its deformation; the residual rayon tire flat spot is relatively shallow compared with that observed for the nylon tire, which having become more comfortable in the loaded state is more reluctant to resume its original contour.

It has been concluded that both the flat spot depth and its rate of removal can be improved in nylon tires by in-

creasing the modulus of the cord as it lies in the tire and by reducing its tendency to creep, particularly when under compression. Modulus and creep can be measured in the laboratory.

Q. What are the prospects that nylon and Dacron can be modified to eliminate the need of pretreatment for adhesion?

A. Heckert. We have no information indicating that the affinity for rubber of nylon and Dacron polyester fiber can be improved to the point where dipping will not be necessary.

Q. Are there any new synthetic fibers in the development state which will be of interest to the mechanical rubber goods producer? What special properties do they have?

A. Heckert. Type 272-F Super Cordura adhesive treated, high-tenacity rayon with all the physical properties of Type 272 is proving to be of interest to mechanical rubber goods manufacturers. A special finish has been applied to promote adhesion to rubber under wet and dry conditions. In belts made with this yarn, when going from the dry state to the wet state, the adhesion drops 10%, as compared to about 70% for belts using standard yarns and the RFL dip.

Q. What method is recommended for the tensile testing of super-high tensile belting ducts?

A. Schwarz. The grab method is generally specified for testing high-strength filament-yarn belting constructions. In order to minimize slippage at the jaws, the test specimens should be coated with a plastic material at the areas in contact with the jaw surfaces.

Q. It has been observed that Type 300 tire cord yarn loses strength rapidly when heated in air at 350° F. What is the mechanism of degradation; what are the degradation products; and in what percentage are they present?

A. Heckert. Type 300 tire cord exposed to air at 350° F. will lose strength and this loss is a direct result of oxidation. The molecular structure is broken up; the chain length is reduced, and some cross-linking and gelation take place. The kind of degradation and the percentage produced depend on a number of factors including temperature and the amount of oxygen present. We have not identified all of the degradation products formed.

Q. Compare the requirements for cord used in passenger-car, farm, truck, bus, and aircraft tires.

A. Kovac. Tires have many characteristics in common that define the requirements of potential or usable tire cord materials. In addition, service conditions of each type of tire will demand slightly different performance.

In general, all tires must possess

bruise resistance, fatigue resistance, separation resistance, high-speed performance (heat resistance), good dimensional stability (low growth), good tread wear, moisture resistance, acceptable esthetic properties, and low-cost-per-mile performance.

Truck and bus tires require emphasis on bruise resistance, high-speed performance, low growth, and good tread wear. Aircraft tires need bruise resistance, high-speed performance, and light weight. Off-the-road and tractor tires require bruise resistance and moisture resistance. Passenger-car tires must have bruise resistance, fatigue resistance, high-speed performance, separation resistance, and acceptable esthetic properties (i.e., ride, noise, and flat spotting).

Q. What factors are involved in compounding latex for cord impregnation?

A. Borg. First, the compound must be tailored to the job at hand; the right latex or mixture of latices must be used, and casein and a resin, if necessary. Then the compound must be adjusted to the cord dipping equipment, the solids content specifically.

Q. What factors are involved in the selection of cord for tire or belt use? Please comment on cost, denier, strength, dimensional stability, effect on product construction, effect on product performance, and relative advantages of different fabrics.

A. Kovac. There are many ways to attack the problem of developing a cord for tire use, and most of the procedures are based on some of the following thinking outlined below.

When a prospective tire cord material becomes available, samples are obtained for laboratory evaluation. Material cost is no factor at this stage of development. Denier and cord size are usually based on existing deniers in use with other materials, existing cord gages, denier that gives optimum properties during manufacture of the yarn, calculations involving inch-strength in the tire, rivet area, etc., and the whim of the yarn manufacturer and accidental occurrences.

The new cord is then given a thorough physical check-up in the laboratory. One or more twists will be chosen. Processing to give optimum cord strength, fatigue resistance, and dimensional stability is determined, utilizing existing equipment, if possible. The cord is then ready for testing in the tire. Chances are that the initial tests will be poor. Then the cord goes back to the laboratory for additional work. Twist may be changed. Processing will be changed. New rubber compounds will be developed that work better with the new cord, and by this time the yarn manufacturer usually has improved his product.

After many more tire tests it will be decided that new equipment is needed

to treat or process or stabilize the material.

Now a satisfactory tire is ready for production. The tire may still have weaknesses, but it must have one or more strong points that make it salable.

Cost now enters the picture. The tire is introduced at a premium since development costs have been high and production low. As production increases, cost may drop, and in the meantime the yarn maker may drop his price.

Often the cost is still too high. Basic changes must be made. Optimum denier is reevaluated (hence the interest in large nylon cords).

Often an entirely new construction must be devised before the tire cord material will show promise (such as the X or radial construction for wire).

This procedure is repeated many times by tire manufacturers. Some of these new cord materials pass all the hurdles and make important contributions to improved tire performance; others are dropped along the way.

A. Schroeder. The designer of belts considers the same general aspects as does the tire designer, but he may weigh the importance of various characteristics differently because his products demand a different set of properties.

In view of the obvious differences between tires and belts, it may surprise some of you to learn that certain belts are regularly made using rayon or nylon tire cord because they produce the best belt for the service required. Belts for other applications require cords of different design, but the selections were made using the same basic considerations.

Q. What differences in cord requirements will there be in butyl rubber tires as compared with current tires?

A. Kovac. In general, butyl rubber tires have similar cord requirements as conventional tires such as the need of adequate bruise and fatigue resistance. Butyl tires seem to suffer from higher running temperatures, poorer adhesion, and greater power loss; therefore any cord that will help these items should be evaluated. In addition, since butyl rubber tires show improved tire esthetics (i.e., better ride and less noise), then a cord for a butyl tire does not have to rank so high in contributing to these properties or their elimination. Also, since butyl rubber possesses excellent aging and crack resistance, a higher growth cord might be tolerated. In brief, nylon would appear to be the best available cord for butyl rubber tires.

Q. Discuss fabric used for fire hose.

A. Schroeder. When a textile is selected for making fire hose, the designer is interested not only in burst strength but abrasion and snagging resistance, weight per unit length, flame resistance, and chemical and water resistance. Some textiles will permit the hose to

be rolled into a smaller package, and this factor permits loading more lengths of hose on to a given vehicle. Some users want hose jackets that clean easily. A textile that will result in a minimum of twisting and length change in the hose is important.

With such a complex combination of product requirements, many fibers and fiber combinations have been and are currently under consideration.

Q. Chemically, which types of nylon are best for rubber and latex applications?

A. Heckert. We believe Type 700 nylon is the best type for rubber and latex applications if the end-product is expected to be resistant to flex fatigue, bruising, growth, and/or heat.

Q. Have the new elastomers created a need of modified or different fabrics?

A. Schroeder. In general, new elastomers have not required new fibers or fabrics. Cotton can be used with styrene-butadiene (SBR), nitrile-butadiene (NBR), butyl (IIR), neoprene (CR), and chlorosulfonated polyethylene rubbers (Hypalon). A new elastomer may offer potentialities which cannot be realized with existing fibers. For example, if silicone rubber had been introduced at a time when only cotton was available, its excellent heat resistance could not have been fully realized until a superior textile was developed.

A. Borg. In some ways the answer is yes because the trend from cotton to rayon in tire cord was accelerated by the use of the hotter-running SBR in tire treads and carcasses during and after World War II.

Q. How can the thermal shrinkage of Dacron be controlled during the vulcanizing of V-belts?

A. Heckert. Chill the mold to 150° F. before stripping the Dacron-containing V-belt from the mold after vulcanization.

Q. How can one normalize Dacron cord so that it will have similar elongation to rayon without reducing the Dacron's tensile strength?

A. Heckert. The elongation of Dacron cords can be reduced to 8-9% by hot stretching at 440° F., using 90 seconds' exposure and a net stretch of 6-7%.

Q. What precautions should be observed in treating nylon fabric with an RFL system?

A. Heckert. We have encountered nylon degradation in single end processing of cords at 425° F., when dip pick-up exceeded 5.5%. An increase in the pH of the dip from 9.5 to 10.5 eliminated this problem.

Q. Is there a minimum temperature requirement for the drying of RFL treated cords?

A. Borg. It is necessary to get all of the water out of the cord to avoid the development of blows in the curing press, which can be accomplished by drying at any slightly elevated temperature. Reasonably higher temperatures are used, however, in order to keep the drying time to a minimum.

Q. What is a typical cord dip formulation based on 2-vinyl-pyridine latex? What is the best mixing procedure? What is the storage life of such a mixture?

A. Borg. Formulations vary considerably, depending upon the fabric type, the equipment used, and local preference. Generally, the resorcinol-formaldehyde is made up with most of the dilution water and with the pH adjusted to 9.5-10.5. To this is added the latex or latices and, finally, the balance of the water. Thorough but mild agitation with a minimum of shear should be used throughout the mixing operation. Thereafter, agitation should be intermittent. The finished mix should not be allowed to form a skin. Such a mix is stable for several days at least.

Q. What is the basis for establishing the twist structure and its magnitude in the cord?

A. Heckert. Twist is used in tire cord primarily to increase flex fatigue, and as twist is increased, the strength of the cord decreases. When high strength and high flex resistance are desired, both must be considered in establishing the optimum twist level. Normally we use a balanced twist and prepare a series of grey cords using twist multipliers ranging from 7 to 9. These cords are then hot stretched, and the fatigue and strength level of the hot stretched cords are determined in the laboratory. We select the twist multiplier that gives the highest level of CT fatigue with only a minor drop in tenacity.

Q. Of the types of machines available for testing tire cord, there are the commonly used constant rate of extension machines, such as the Scott⁴ X-3 or X-5; the inertialess constant rate of elongation machine, such as the Instron⁵ tester; and the constant rate of load machine, such as the Scott IP-4 machine. Which would be the most suitable of the above machines for testing tire cord?

A. Kovac. Any of these three types of testers can be successfully adapted to a tire cord testing program.

For acceptance testing, the IP-4 is probably the most desirable since its operation is rapid, and variations in strength and stretch are small. For development work, the Instron tester or the Scott J-5 tester with accrometer are more desirable since they are more flexible. Provisions for testing at high

temperatures can be easily attached to these instruments, and they have the ability to handle both normal and larger-than-normal size cords.

Q. What is the chemical or physical-chemical mechanism of the RFL adhesive material used for bonding a treated tire cord to skim stock?

A. Borg. In the case of cotton and rayon, it is thought that the RF actually reacts chemically with the hydroxyl groups on the fiber, thereby promoting adhesion. With nylon the function of the RF resin is probably purely mechanical; it serves to reinforce moderately the polymer deposited on the cords from the dip bath.

Buffalo RG Hears Neu

Robert F. Neu, Enjay Co., Linden, N. J., addressed 89 members and guests of the Buffalo Rubber Group at a meeting at the Hotel Westbrook, Buffalo, N. Y., March 4, on "Dynamic Properties of Butyl Rubber as Related to Its Applications." The technical session preceded a cocktail hour and dinner at which the new executive committee members were introduced, and Vincent Richards, vice president, The Dunlop Tire & Rubber Co., received a standing ovation on being introduced to speak on sports, in particular, tennis. Mr. Neu's speech, which was illustrated with slides, is summarized below.

Butyl vulcanizates have been characterized as materials that combine dynamic softness with excellent shock absorption. These features present an opportunity for the fabrication of a wide variety of mechanical goods articles from heavy-duty shock absorbers to smaller sound and vibration damping mountings.

Specific applications in these categories would include: railroad coupling shock absorbers, load cushions, automobile axle bumpers, auxiliary spring and bumper guards. Other applications in the same categories would be: Silent Blok bushings, body shims, and instrument mountings.

Adhesion to steel has been facilitated by certain commercial cement combinations and adhesion to brass by combinations of Enjay Butyl and polar elastomers, notably Hypalon (chlorosulfonated polyethylene). A wide range of dynamic properties can be obtained through variations in pigment-polymer mixing conditions, type of filler, and plasticizer content. The performance of butyl tires reflects the dynamic qualities that can be given to butyl rubber compounds.

The next affair of the Buffalo Rubber Group will be a joint meeting with the Ontario Rubber Group, CIC, at the Hotel Sheraton Brock, May 9. B. S. Garvey, Pennsalt Chemicals Corp., Philadelphia, Pa., will be guest speaker.

⁴ Scott Testers, Inc., Providence, R. I.

⁵ Instron Engineering Corp., Quincy, Mass.

SRG Panel on Statistical Quality Control



Moderator and panel members of SRG Symposium on SQC and Rubber Grading

The second panel discussion of the Southern Rubber Group meeting held on November 15 and 16, 1957, at Memphis, Tenn., was on statistical quality control and rubber grading. The moderator for the panel discussion was J. H. Sparks, Robbins Floor Products, Inc.; and the panel members were O. R. Weaver, Phillips Chemical Co.,

and L. N. Freeman, The B. F. Goodrich Co., both on statistical quality control; and S. J. Pike, S. J. Pike Co. and T. A. Desmond Co., on rubber grading.

The accompanying photograph shows the moderator and panel members.

An edited transcript of the papers presented follows.

An Introduction to the Theory of Quality Control

O. R. Weaver

*Phillips Chemical Co.,
Bartlesville, Okla.*

WHEN Eli Whitney signed a contract with the United States Army to mass produce muskets during the War of 1812, he undertook a task which nearly ruined him financially, but which may have planted the seed for statistical control of quality as we know it today.

Muskets had always been hand-made items. Each piece was individually fashioned to fit a specific gun. No parts were interchangeable, and when a part broke or wore out, a new piece was formed to fit. Whitney reasoned that if all parts were fabricated by a template or jig, then all the parts would be "exactly" alike, and guns could always be assembled, using any of the previously manufactured parts.

Mr. Whitney erred, however, in making the assumption that all parts would be "exactly" alike. To his sorrow he soon found that no two parts were exactly alike although in many instances they might be interchangeable. Thus he became acquainted with variability even though he probably did not use this term to define the condition.

Since that early date, product and process variability have been the subjects of much discussion in all phases of industry, and many manufacturers of various kinds of product have faced the same financial ruin which plagued Eli Whitney because they too had assumed that parts could be made exactly alike.

Early in the Twentieth Century statisticians and engineers compared notes

and found that the same laws of probability which applied to dice, cards, mortality, intelligence, and other sociological, biological, and statistical events were equally applicable to manufacturing processes.

Measures of Dispersion

Some observations which we are able to make regarding a manufacturing process, if it is behaving in a normal manner, include:

(1) It will produce material which, if it can be measured, will have a central tendency commonly called "average," i.e., a mean, mode, or median.

(2) This material will vary from the central tendency within certain limits which can be calculated.

(3) Once the central tendency and the variation from it are ascertained, a probability can be established for the occurrence of material in any measurable distance from the central tendency.

(4) Whenever material is being produced outside the measured limits calculated for the process, we can be sure (to whatever degree we wish) that chance alone has not caused this change in the process, but that some assignable cause is to blame for the variation.

We need to define central tendency—mean, mode, and median. Each of these terms describes a different central point of a distribution. The mean is the arithmetic average of a group of numbers. It is found by summing all of the numbers and dividing the sum by the number of numbers. Expressed

mathematically it is

$$\bar{X} = \frac{X_1 + X_2 + X_3 \dots + X_n}{N} \text{ or } \frac{\sum X_i}{N}$$

The median is the middle number of a distribution arranged in ascending or descending order. The mode is that point in a distribution at which the greatest frequency of events occurs. The mean is the most commonly used measure of central tendency.

The variation about the mean is usually measured in terms of the standard deviation. The standard deviation (commonly expressed as s^1) may be found by the following formula

$$s = \sqrt{\frac{\sum (X_i - \bar{X})^2}{N - 1}}$$

It is a mathematical expression for the distance from the mean to the place on the normal distribution curve where the curve changes direction. The formula, spelled out in words, is the square root of the quotient obtained by dividing the sum of each squared individual deviation from the mean by one less than the number of observations.

There are other methods of expressing deviation such as the range.² The range is merely the difference between the largest and the smallest reading which we obtain. The mean deviation has no value since the sum of the individual deviations from the mean is always zero. Some statisticians have tried to average the deviations without regard to their signs, but this resultant figure can lead one into blind alleys. We generally stick to the standard deviation which gives us the most accurate picture of variation.

Chemical Process Control

Let us for a moment examine some

¹The standard deviation described above is that computed from a sample drawn from an infinite (or very large) population. The "population" standard deviation is defined as $\sigma = \sqrt{\sum (X_i - \mu)^2 / N}$, where μ is taken to be the "true population" mean. This standard deviation is sometimes called the root mean square deviation.

²There is a relation between the average range and σ ; and the range is used in many statistical quality control calculations.

TEMP.°F.		FREQUENCY	RELATIVE FREQUENCY	CUMULATIVE FREQUENCY	CUMULATIVE RELATIVE FREQUENCY
290.4	II	2	.005	2	.005
290.5	II	2	.005	4	.011
290.6	III	3	.014	7	.025
290.7	IIII	4	.016	11	.041
290.8	IIII	4	.019	15	.060
290.9	IIII II	6	.066	21	.126
291.0	IIII II II	9	.099	30	.225
291.1	IIII II II II	12	.132	42	.357
291.2	IIII II II II II	16	.176	58	.533
291.3	IIII II II II II II	21	.140	79	.673
291.4	IIII II II II II II II	24	.113	103	.786
291.5	IIII II II II II II II II	32	.088	135	.874
291.6	IIII II II II II II II II II	24	.066	159	.940
291.7	IIII II II II II II II II II II	12	.033	171	.973
291.8	IIII II II II II II II II II II II	5	.014	176	.986
291.9	IIII II II II II II II II II II II II	4	.011	180	.997
292.0	I	1	.003	181	1.000

Fig. 1. Tally sheet and relative frequency of control temperatures

(Left)
Fig. 2. Histogram of control temperatures. Y axis is frequency; X axis, coded values of temperature

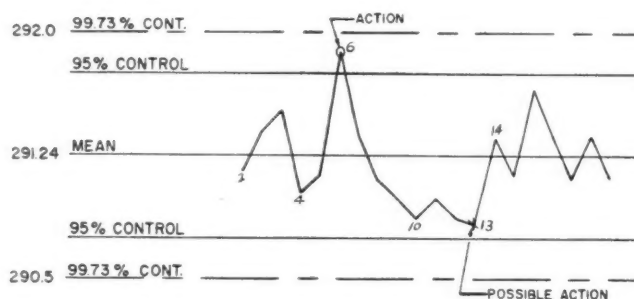


Fig. 4. Statistical control chart for control temperatures

data from a chemical process operating to produce a satisfactory product and assumed to be controlled. One of the variables which we wish to control is temperature, and we have a very accurate temperature gage calibrated in tenths of a degree F. The following data, shown in Figure 1, were collected.

When plotted on squared paper, it forms a distribution (Figure 2) called a histogram. If our temperature gage were calibrated in smaller divisions and each one were proportionally accurate, we would obtain readings between each tenth degree, and as we decreased the width of the blocks, we would finally get a curved line over the histogram (Figure 3).

By the formulae previously mentioned we can calculate the mean and standard deviation to be 291.24 and 0.254° F., respectively. We could calculate the probability of an occurrence at any level, but tables have been prepared to save us the effort. We find from these tables that 68% of the occurrences will be between 290.986 and 291.494° F. Thus we have a prob-

ability of 68/100 that any reading we take will be between these two temperatures.

We also find that 95% of the occurrences are between 290.732 and 291.494° F.

748° F., and 99.73% of the time, between 290.478 and 292.002° F. By subtraction, we can determine that the probability of a temperature reading over 292.002° F. in this process, when it is behaving normally, is only 135 in 100,000 or slightly greater than 1/1,000.

I was asked to discuss the theory of quality control, but if I may, I'll speak for a moment as a practical man engaged in the use of quality control in chemical processing industries. If I find a temperature on this process which is 292.1° F., I can assume that some cause other than chance variation is acting on my process, and I'll be right 999 times

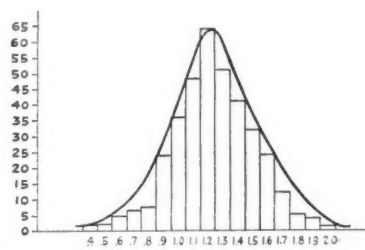


Fig. 3. Distribution of control temperatures plotted as a continuous curve. (Axes same as in Fig. 2)

out of 1,000. My process is no longer in control. Some assignable cause is at work, and it is up to me to find out what it is and to correct it in order to make a satisfactory product.

But ordinarily you will not want to make such a complicated set of analyses each time your process goes out of control. You will want a tool which can be used so that the operator in a plant will know as quickly as possible when he needs to correct his process. Control

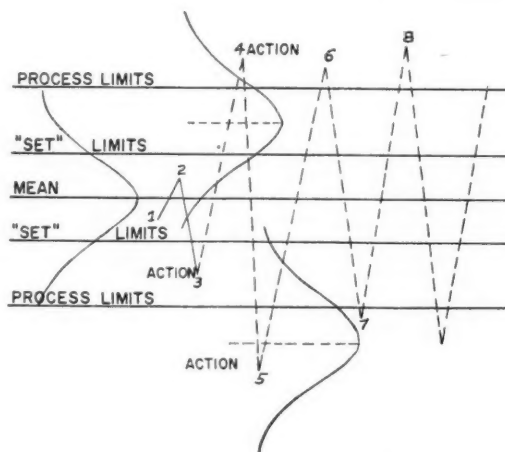


Fig. 5. Process capability chart

charts have been devised to tell you almost instantly the probability that an assignable cause has begun to act on the process.

Using the data we obtained from our

PERCENT. MOISTURE	MIDPOINT %	NUMBER OF OBSERVATIONS	FREQUENCY	RELATIVE FREQUENCY	CUMULATIVE REL. FREQ.
0.50-0.54	.52	I	1	.015	.015
0.45-0.49	.47	III	4	.061	.076
0.40-0.44	.42	III III	9	.136	.212
0.35-0.39	.37	III III II	12	.182	.394
0.30-0.34	.32	III III III II	17	.258	.652
0.25-0.29	.27	III III III	13	.197	.849
0.20-0.24	.22	III I	6	.091	.940
0.15-0.19	.17	III	3	.045	.985
0.10-0.14	.12	I	1	.015	1.000
$\bar{x} = \frac{2152}{66} = .326$			$s = .084$		

Fig. 6. Tally sheet and relative frequency of per cent. moisture in a chemical compound

temperature study, we can prepare a control chart (Figure 4) for either 95 or 99.73% probability. We could use also any other probability we wished. At convenient intervals of time we take temperature readings and plot them. When a point such as No. 6 falls outside the control limits, we take action to remove the assignable cause. We might also wish to do something at point No. 13. You will note that six times we obtained readings below the mean. There is an equal chance on any reading to get a point below or above the mean. But the probability of six successive points below the mean is $(\frac{1}{2})^6$ or $\frac{1}{64}$. Thus $\frac{63}{64}$ times we would be correct if we assumed that assignable causes were at work.

I am sure at this point that someone is thinking, "We have limits at our plant, and we don't go through all these mathematical acrobatics to get them. We just set them."

Fortunately, sometimes that works real well, but sometimes it doesn't. Here (Figure 5) is what can happen when the limits are set with too small a tolerance band.

Points 1 and 2 are within both the "set" limits and the normal process capability limits so no action is indicated. Point 3, however, is a full unit below the "set" limit. If we take action to bring it back, we will disrupt the normal operation of our process and shift the distribution curve. Because we have shifted the mean of the distribution (to the first dotted line in the figure), point 4 logically may be found not only above our artificial limits, but also above the original process limits. When we try to correct our upset process again and again, we may well produce material which would be plotted at points 5, 6, 7, etc. and are outside the normal process limits.

Product Control

We can apply the same kind of statistical techniques to a finished product

TENSILE	NO. OF OBS.	FREQ.	REL. FREQ.	CUM. REL. FREQ.
8	II	2	.050	.050
7	III	5	.125	.175
6	III III	10	.250	.425
5	III III III	14	.350	.775
4	III	5	.125	.900
3	III	3	.075	.975
2	0	0	.000	.975
1	I	1	.025	1.000
$\bar{x} = 5.275$		$s = 1.414$		

Fig. 7. Tally sheet and relative frequency of tensile strength of fibers (coded data)

and predict with reasonable accuracy what percentage of product lies within any limits. Here (Figures 6 and 7) are two examples.

desirable material. Our finished product will be more uniform and of a higher quality, and customers will be generally more satisfied.

Method for Application of Statistical Quality Control in the Manufacture of Rubber Products

L. N. Freeman

The B. F. Goodrich Co.,
Akron, O.

STATISTICAL quality control provides a means of eliminating guesswork where quality is concerned and thereby permits a factual study of errors in a process. Knowing the source of error, it is then possible to revise the process, improve the equipment, or retrain operators until these errors are on the downward path or are eliminated.

Anyone who has worked for any period of time in the manufacture of rubber products is soon confronted with the many variables inherent in the process and soon realizes control of the variables with subsequent reduction or elimination is the only way to successful operation.

In rubber products manufacturing there are not only variations in raw materials, but an attempt is made to make some products where the chemical reaction known as vulcanization is stopped short of completion. In addition, the ultimate goals of the shortest

time for vulcanization and the shortest time of processing are the constant objective. Frequently these two goals are diametrically opposed.

The difficulty of measuring or having reproducible control tests for processing operations as well as the finished product is a frequent problem to the rubber engineer. Chemical analyses are too slow in many instances as control tests; therefore, regardless of the process being a chemical reaction, physical tests must be resorted to for controls. Frequently these physical tests, owing to the inherent variable qualities of rubber products, are difficult to reproduce within close tolerances.

These are the problems that make rubber goods manufacturing a fertile field for S.Q.C. Following is a description of how one rubber products manufacturer has used S.Q.C. in helping control these variations.

First, a consulting S.Q.C. group was established in the central laboratories in Akron. This group consists of mechanical, chemical, and industrial engineers, and their services are made available to all parts of B. F. Goodrich on S.Q.C. problems. If a foreman, production superintendent, plant manager, engineer, or any one in the Goodrich company wants a process or product studied as to the possible advantages of S.Q.C., he contacts this group.

It will study the process or product, make recommendation as to whether or not S.Q.C. will save money and/or give improved product. If either of the latter two requirements are met, then this group will recommend a plan and help implement it until the department can on its own carry it to a satisfactory conclusion.

S.Q.C. in Physical Testing

In order for this consulting group to have basic information on rubber manufacturing problems, and in order for the Goodrich company to have a "working model" so to speak, the first application was made in the physical testing laboratory. In this laboratory are duplicates in miniature of the large rubber manufacturing equipment used in the production departments. The same operations are carried out as in the factory; the only difference is that the factory is dealing in batch sizes from 500 to 1,000 pounds while the laboratory is dealing in ounces up to two pounds.

In addition, the laboratory is necessarily confronted with the need for greater accuracy of results which requires good processing control. In this laboratory hourly-rated people are employed both on a piece-rate basis and straight hourly rate so that the laboratory supervision is confronted with problems similar to those of the larger-volume production departments. In view of this factor, the first assignment to the consulting group was to apply S.Q.C. in this laboratory at a savings in dollars and cents to the company.

This was accomplished as will be described later.

It has been very fortunate that this approach was used with S.Q.C. for it has proved psychologically sound to all parts of the organization. First and most important, no one was pointing a finger at a production operation or suggesting that this or that process would be better for using S.Q.C. A practical example of the value of S.Q.C. was being operated in the laboratory which is recognized by both engineers and production people alike as a place where a greater degree of accuracy is needed than in a production operation. Here it was demonstrated how S.Q.C. could reduce costs of operation through improvement in accuracy.

In this laboratory more than 1,000 dumbbell test specimens are pulled per day on machines to determine tensile strength, elongation, etc. To prepare these test specimens, it is necessary to compound, mix, and vulcanize more than 100 batches of rubber per day. This operation is large enough really to demonstrate the value of statistical quality control.

The goal was established to adapt S.Q.C. to testing methods at a reduction in cost. Rubber testing is not an exact science. One of the most frequent tests run is the stress-strain test. This is run on a dumbbell-shape piece of rubber stock. It has been customary through years of rubber technical work to die out and pull three dumbbells from each experimental test sheet to obtain one average result. The only excuse for pulling three dumbbell test pieces was that the variables involved were too poorly controlled to depend on less than three results. Permission was obtained from the engineers using these results to eliminate the pulling of one of the three dumbbells if it would be possible to get better correlation between two. In other words, S.Q.C. would pay its way even in a laboratory if it really did a job.

The next step was to determine how to improve on the quality of dumbbell testing.

The men working in this laboratory were well experienced in their jobs. The majority had worked on them more than 15 years—they knew how important it was to do their jobs accurately and were attempting to do so. There was no labor turnover on these jobs. *The one thing that was missing was immediate knowledge by the men as to what quality work they were turning out at each step of the operation.*

This laboratory was no different from any other production operation—the error frequency before S.Q.C. was no different from what would be found in any production department or laboratory where repetitive operations are performed.

A recipe or compound is received from the technical man for an experimental trial. The number of ingredients in each recipe varies. Each must be

weighed; then the batch is mixed on mills or in a laboratory Banbury; sheeted out; a section cut of proper thickness and size for vulcanizing a tensile sheet; after vulcanizing, dumbbells are died out, gaged, and pulled on a stress-strain machine.

The first operation consists of weighing out the materials required in the experimental recipes. Each ingredient is weighed in a separate container. These weighings are put through in lots and sampled according to S.Q.C. tables. Each sample taken is weighed on a different scale or balance than the original weight was made on and by another operator. The difference between these two weighings is recorded. Limits were established through S.Q.C. methods for each type of scale or balance used.

If the sample taken from the lot is within the established tolerances, then that group of "batches" or weighings is ready for the mixing operation. If the sample does not meet the established S.Q.C. requirements, then *all* of the weighings in that lot are checked—any errors corrected—and the lot resubmitted for S.Q.C. sampling. If it passes the requirements, then the lot is ready for the mixing operation.

After mixing, the batches are vulcanized in standard rubber vulcanizing presses. The foreman "samples" the press temperatures at intervals each shift and records the found temperature against the requested temperature on the order.

The next operation that is vital to the accuracy of the stress-strain test is that of gaging the thickness of the dumbbell test piece. This operation is done on a piece-rate basis. The laboratory supervision didn't know to what degree of accuracy the operators were doing this job, and neither did the operators themselves. The accuracy of this measurement materially affects the following stress-strain determination.

Normal S.Q.C. studies were made to determine what accuracy was possible using the gages required. From these data, limits were established, and control charts prepared. In this case it was found that in gaging dumbbells (using a gage which reads to 0.001-inch) the limits would have to be ± 0.002 -inch. Controls were then established for the gaging operation by putting the dumbbells through in lots and sampling according to S.Q.C. tables.

Again, as in the case of the weighings, if the sampling plan indicated the lot should be rejected, then each of the dumbbells was regaged, and the lot resubmitted for S.Q.C. sampling and approval prior to pulling the dumbbells. The pieces in the S.Q.C. sample are gaged by another operator using a different gage—this way a check on the gages as well as the operator's work is obtained.

At the outset the agreement was that if the two dumbbells pulled varied by more than a given percentage, a third

would be pulled so that the technical men would be guaranteed as good results as they had been receiving, with a chance for improvement as the men in the laboratory (through S.Q.C.) learned the true quality of work they were doing. This plan has reduced the number of third-dumbbells pulled by approximately 135,000 per year. This result is the direct saving which pays for sampling and checking. Naturally, with improved accuracy, the development man's work reflects much greater savings.

Goodrich has a number of control stations in plants throughout the country. These control stations are testing independently of each other and of the main physical testing laboratory. Each of these control stations is making gravity determinations, hardness tests, etc. The problem was not only to determine the accuracy of the work done by the operators, but also to determine defects in equipment which occur from time to time where large numbers of tests are being made.

As is customary, a sample is taken from each batch of mixed stock—the test sample died out, and the required test or tests run in the control station. In order to set up a control on this testing, the batch samples from which the control sections were cut were sampled at random. These samples were forwarded to the main physical testing laboratory where samples were cut out, vulcanized, and tested. The difference between the control station's determination and the main physical testing laboratory is plotted on the control chart. This control has made it possible to find instruments which have gone off calibration as well as human errors.

S.Q.C. in Production

One of the big problems confronting the S.Q.C. engineer is how to do the job at decreased cost to the production department. An experimental or pilot run is sometimes necessary before savings can be demonstrated for it is not unusual for unexpected benefits to accrue through the use of S.Q.C.

Another problem which S.Q.C. brings right up to the front is the definition of quality. Older methods permitted a broad definition of a given quality; in fact, it was not unusual for different shifts to have a different conception of defective and good material.

In order to solve some of these problems on a tough inspection job—hydraulic brake cups—the following plan was formulated.

As a part of the regular production operation, hydraulic brake cups are 100% inspected under a magnifying glass.

In order to define when a cup is defective, representative samples of all the defects encountered in the manufacturing process were established, and these defects photographed to the same magnification as the inspectors used

with the magnifying glass. This plan provided a ready reference for the inspectors if they were in doubt about whether or not a certain-type blemish was a defect.

These "photographic standards" were supplied the inspectors for ready reference.

An S.Q.C. sampling and control plan was worked out for the 100% inspected cups, using the same photographic standards. As a result of the inspectors having the same reference point (photographic standards), not only the quality level going to the customer improved, but also the number of good cups being thrown into scrap decreased. The latter, of course, really paid the S.Q.C. bill.

Raw Material S.Q.C.

One of the major problems in rubber manufacturing is the uniformity of the materials being used. It has been common practice for the manufacturer of the raw material to run control tests on the product during the course of manufacture, and then the user sample and run tests on the shipment when received at the manufacturing plant. In order to establish a working procedure which can apply to all materials and eliminate this duplicate testing, the following system has been worked out with suppliers:

1. The manufacturer statistically samples the product and runs tests during production. These data are forwarded to the using plant to arrive ahead of the shipment so that the using plant technical group will know the quality of each lot of material as it was manufactured.

2. In order to be assured the laboratory equipment does not get out of adjustment and to insure operator accuracy, the control work going through the manufacturer's laboratory is sampled statistically, and these samples are forwarded to the using plant for check testing. The differences between the manufacturer's test and the using plant tests are plotted, and if within specification requirements, the shipments are released on the manufacturing control tests.

This procedure has resulted in a real decrease in the amount of testing done, with improved quality of product and the elimination of many delays.

It is anticipated all raw materials can be placed on this or a certification basis.

S.Q.C. for Tires

Another of the major fields of application has been tires. The rapid expansion of the tire industry since World War II has brought with it the problem of coordinating manufacturing over a wide geographical area so that the customer will get the same Goodrich tire whether it is manufactured in Los Angeles, Oaks, Pa., or any of the other Goodrich plants.

Statistical quality control groups

were established at each of the manufacturing plants; the manager of each group reports to the plant manager. This system makes it possible for the plant manager to have at his fingertips all the available S.Q.C. information.

The same in-process S.Q.C. controls were adopted that had proved of value in the laboratory and other manufacturing areas, such as, compounding, mixing cycles, control tests, green tires, finished tires, balance, etc.

As an aid to bring about the uniform interpretation of specifications at all plants on finished tires, photographic standards were established. In each case a photograph of a tire that met specification requirements and one that was beyond specification limits were supplied each S.Q.C. group.

Balance has long been a tough problem to control in tires. One of the fallacies S.Q.C. brought to immediate attention was the variation in the measurement of balance on the standard equipment common to the tire industry. As soon as S.Q.C. established the limits within which the same tires could be balanced on different machines of the same type by different operators, S.Q.C. control using these limits was placed on finished tires. The uniformity of tire balance to the customer started improving immediately.

It is in this field that S.Q.C. usually is most valuable in a manufacturing process. Usually the production department and the technical and development departments do not agree with S.Q.C. limits. It is not unusual for both production and engineering to indicate that the S.Q.C. limits, as calculated, are too wide; however, after the S.Q.C. limits are in operation, it is always interesting to watch the improvement in quality.

In the S.Q.C. procedure for manufacturing plants, the normal controls were established on the basis of percentage major and minor defects plus quality-level requirements. This provides each plant with the tools to know what quality level is being shipped.

Quality Audit

As a final step to arrive at a uniform interpretation and application of specifications at all manufacturing plants, a quality audit was adopted.

The quality audit is made to the same specifications as the plant S.Q.C. group uses in controlling the daily production.

Two methods are used for conducting a quality audit: (1) divert a car of finished tires that is on the way to the customer from a plant to a quality auditing station; (2) send the quality auditing group to a warehouse to take a sample of a given plant's production and audit it. The auditing committee is composed of S.Q.C. managers from plants other than the plant being audited and/or men from the consulting S.Q.C. group.

Each tire in the sample is inspected carefully for all visible defects, and the balance determined on each tire in the

sample. The major and the minor defects are recorded the same as is done by the plant S.Q.C. group, and from these data a quality level for the audit is calculated. This resulting quality level provides the plant manager with the following information: (1) the customer's acceptance of the product; (2) specification interpretation; (3) those areas where technical and production groups need to concentrate their efforts to improve the product.

This information has also been invaluable to the field engineering group. These quality audits provide up-to-date information regarding the percentage of major and minor defects being shipped by all plants so that a service complaint can be evaluated properly.

The method of applying S.Q.C. that this paper describes, is not an overnight process, or is it a miracle worker. It has been developed over a number of years, each year showing improvement over the previous year. By following this method of application, improvements in quality have continued on an ascending scale which are resulting in benefits to both the user of the product and the manufacturer.

Rubber Grading

MR. PIKE'S talk was in the form of a travelogue of the Far Eastern rubber producing countries. Some 500 colored slides were shown depicting the production, grading, and packing of natural rubber.

Rubber production in the Far East is, according to Mr. Pike, nearly evenly divided between European owned estates and native estates.

Mr. Pike described the processing of latex as produced by the tree into the form of crude rubber known as Pale Crepe and #1 Sheets. Tree scrap, cup-lump and cup-washings, and plant clean-up, Mr. Pike stated, are the basis of #2, #3, and #4 Brown Crepes. A raw material known as earth scrap is used primarily for the production of Flat Bark rubber. Mr. Pike described the various grades of Flat Bark and pointed out that the soft types are the result of drying by artificial heat (European estates); while the other grades result from air drying on native estates.

Mr. Pike stated that little of the latex is screened on the native estates, and as a result of this practice, much of the "native rubber" is manufactured into F.A.Q. (Fair Average Quality or #3 RSS) Ribbed Smoked Sheets.

In the areas of Palembang and Djambi, and to some degree in North Sumatra, Mr. Pike observed that much of the latex is made into wet slabs, the basis of #3 and #4 Amber Crepes.

Mr. Pike concluded his talk with a description of the production of #2, #3, and #4 Browns from the Medan area of North Sumatra.

Bulifant Discusses Polyethylene before Tlargo

The Los Angeles Rubber Group, Inc., held a technical-dinner meeting at the Biltmore Hotel, Los Angeles, Calif., March 4. The technical session was attended by 265 guests and members who heard T. A. Bulifant, Barrett Division, Allied Chemical & Dye Corp., speak on "Low Molecular Weight Polyethylene in Rubber Compounding." At the dinner 75 members and guests heard J. L. Heckel, Aerojet-General Corp., speak on the development and usefulness of earth satellites. Both talks are summarized below.

Various new items were revealed at the meeting. R. E. Scherner, United States Rubber Co., has become a TV star in recent weeks. D. Montgomery, Xylos Rubber Co., has been elected to the board of directors of the Junior Chamber of Commerce, L. A.; while Skip McMahon was elected vice president of the Chamber. R. W. Maney, Goodyear Tire & Rubber Co., has received the Silver Beaver Award from the Boy Scouts of America. F. Holmes has resigned from W. J. Voit Rubber Corp. It was also announced that R. M. Simpson, pigment sales manager, Columbia Southern Chemical Corp., had been visiting in the L. A. area. The 1958 Tlargo Yearbook has been completed and distributed. The editor, C. M. Churchill, Naugatuck Chemical Division, U. S. Rubber, and his staff were said to have done an outstanding job.

Out-of-town guests at the meeting included: C. R. Shafer, Xylos Rubber, Akron, O.; W. B. Welch, Midwest Rubber Reclaiming Co., East St. Louis, Ill.; and G. Flanagan, B. F. Goodrich Chemical Co., treasurer of the Washington Rubber Group.

Mr. Bulifant, in his talk, stated that within the last decade ethylene polymers of low, high, and intermediate molecular weights have become important tonnage materials in rubber, plastics, paper coatings, food packaging, polishes, color dispersants, textiles, inks, paints, and numerous other applications.

Of particular interest to rubber compounders are the low molecular weight (1,500 to 2,000), low density (0.92), and low melting point (88 to 103° C.) polyethylenes manufactured by Allied Chemical & Dye Corp. and marketed under the trade mark "A-C" polyethylene lubricants. Developed several years ago, these ethylene polymers are said to be unique. A study of the physical and chemical characteristics of these materials showed them to be hard, wax-like, non-toxic, non-discoloring, non-migrating, light stable, inert, and resistant to moisture and chemicals.

They behave as processing aids, tack-modifiers, and lubricants. Their compatibility in the different elastomers is relatively high, even when used in concentrations as high as 10 parts to

100 parts of elastomer. The polyethylene lubricants do not bloom from either uncured or cured stocks. These lubricants are also said to contribute to easy release from mill, Banbury, or calender at elevated temperatures. In addition, better mold flow and release properties are obtained. From two to five parts of polyethylene usually are sufficient to provide any necessary improvement in processibility and mold flow properties without causing any major changes in vulcanizate properties.

Laboratory evaluations of the three available grades of polyethylene lubricants in the various elastomers have indicated no significant behavior differences among them. In certain instances, however, one grade may be preferred over the other. The most popular grade is the low molecular weight (1,500) and low melting point (90° C.) material, probably because of its greater ease of dispersion. The three grades, in both pelletized and powdered form, are recommended, respectively, for Banburys and for open mill mixing.

Mr. Heckel's presentation included slides and covered the background, planning, and current activities of the United States participation in the IGY, with particular attention being paid to our earth satellite program and the rocket vehicle that will establish the satellite in its orbit.

A description of the three-stage Vanguard launching vehicle was included along with a discussion of the physical characteristics, launching trajectory, and methods of acquiring and tracking the satellite itself. This talk included a review of the nature of the geophysical information expected to be obtained from the satellite and some future interesting satellite applications. Within the limitations of military security, Heckel answered questions from the floor, following the program.

Chicago RG Meets

M. A. Schoenbeck, of E. I. du Pont de Nemours & Co.'s elastomers laboratory, addressed 245 members and guests of the Chicago Rubber Group at the Furniture Club, Chicago, Ill., March 14. His illustrated talk was entitled, "Continuous Curing by the Du Pont LCM Method." See page 81, this issue.

Business transacted included a report of the nominating committee by A. Laurence, Phillips Chemical Co., chairman. Election of officers will be held at next meeting, on April 25, at the same place.

A special feature of the meeting was the annual Laminar Oyster Bar provided through the courtesy of Maurice O'Connor, of O'Connor & Co.

Detroit Group Discusses Air Springs

The Detroit Rubber & Plastics Group, Inc., held its winter meeting on February 7 at the Detroit Leland Hotel, Detroit, Mich. Attendance was estimated at 100 persons.

The program consisted of talks by E. A. Harper, Firestone Industrial Products Co.; R. D. Harrison, Ford Motor Co.; and D. J. LaBelle, General Motors Corp.

"The Evolution and Manufacture of the Airide Spring." Mr. Harper opened his talk with a brief historical sketch of developments leading to the present status of the truck and passenger-car air spring.

Boiled down to bare essentials, the Airide spring is simply a bag of air, and the compounder's problem is to keep air in that bag! The airbag consists of an inner liner, two plies of fabric, and an outer cover. The purpose of the inner liner is to contain the air. The fabric plies give the bag strength and to some degree influence the deflection rate of the spring. The outer cover serves to protect the plies from abrasion, ozone attack, weathering, and so on.

In the case of passenger-car applications, the inner liner operates in a mist of oil and is subject to high concentration of ozone and other oxidizing agents. These conditions call for an oil-resistant rubber protected by anti-ozonants. As a safeguard against damage by improper lubrication, some manufacturers also specify an oil-resistant outer cover. As a result, neoprene compounds are generally used for both the inner liner and the outer cover.

Good pigment dispersion in the compounds used, Mr. Harper stated, is essential to building a successful air spring. High green strength must be maintained during the building and curing cycles. Stretching as high as 600% is not unusual during these periods. Poor dispersion of pigment also results in loss of tack necessary for smooth carcass building.

The deflection rate of an air spring depends upon the geometry of its design and the character of the two fabric plies that form the spring-walls. The fabric is woven from nylon tire cord. Care must be taken to insure that the load stresses are distributed uniformly among the individual cords and that cord-chafing is eliminated (a cushion stock is used).

Air springs are of two types: both ends open; one end open, and the other closed. The closure may be either metal or rubber. The open ends terminate in a metal bead ring or braided cable similar to a tire bead. This means, the speaker noted, that rubber-to-metal adhesion problems are present.

Two methods of curing are used. One resembles the familiar bladder method

used for tire curing and is used for open-end springs. The other method, an internal steam cure, is used for closed-end springs. The ordinary-size passenger-car spring is cured in about 10 minutes.

Tests run on finished springs include the following: dynamic spring rate—the spring is vibrated at its natural frequency under the design load; static deflection—load vs. deflection curve is obtained; static sealing and air permeability; hydrostatic burst strength; low-temperature flexing—flexing after five hours' conditioning at -40° F.; endurance testing—flexing at a rate of 96 cycles/minute until failure. The stroke used is the full operating range of the spring.

The endurance test is a kind of simulated service test, and the inner liner and the outer cover are compounded to give maximum flex resistance through a liberal use of flex-resisting antioxidants. Here again, the geometry of the design considerably influences the spring's performance. The same compound and basic construction cured into different designs will, said Mr. Harper, give widely varying fatigue life. Although there is no general agreement among automotive engineers as to how many cycles a spring must survive before failure, Mr. Harper stated that 100,000 full-stroke cycles are considered minimum acceptable life for some springs.

Mr. Harper concluded his talk by noting that there are other potential applications for air springs other than the automotive field. These uses include vibration isolation devices, railway equipment, air operated pistons, pallets for air-dropping heavy military equipment, and as bumpers along steamship docks.

"New Commercial Vehicle Concepts Possible with Air Suspension." Air suspension offers, according to Mr. LaBelle, the following advantages in commercial vehicle construction: increased riding comfort—by minimizing transmission of high-frequency disturbances to the vehicle; constant platform height-leveling valves maintain the same ride clearance between axle and frame regardless of static load; decreased suspension maintenance—by the elimination of lubrication and the fact that the principal load-carrying suspension units are not subject to fatigue stresses; reduction of fatigue loads—because high-frequency disturbances are not readily transmitted to the vehicle structure; and lower body—in a standard 35-foot trailer this results in a net gain of 60 to 100 cubic feet of cargo space.

These factors, Mr. LaBelle reported, make possible a new concept in commercial vehicle design. The reduction

of high-frequency fatigue loads will enable designers to use lightweight metals in many places (wheels, hubs, axle housings, cabs) where steel is now used. In other cases, reduction in the size of steel components (beams of varying cross-section for example) in the vehicle frame and the use of more advantageous manufacturing techniques, such as welding, will be possible.

These new design concepts, Mr. LaBelle declared, should result in nearly 2,000 pounds' reduction in the vehicle's tare weight.

"The 1958 Edsel Air Suspension." Mr. Harrison discussed in detail the mechanical engineering features of the Edsel air-suspension system.

An air suspension, as applied to passenger cars, may be considered as composed of three functional groups: the air supply system; the control system; and the spring system. It is with the spring system that rubber technologists are mainly concerned.

The Edsel spring system, according to Mr. Harrison, is composed of four basic parts: the rubber air cell, the retainer band, the piston, and the upper air seat. The rear springs also include clamps at both upper and lower seals to prevent unseating if the shock absorbers are disconnected while the car is on a hoist.

Riding characteristics of any vehicle depend upon the load-deflection curve of its suspension system. The load deflection curve of the Edsel air spring, Mr. Harrison explained, is a function of the piston design, the type of cord in the fabric plies, and the cord bias angle.

New Expense Record

A new classified expense book was recently introduced by Melton Publishing Co., Dallas, Tex., which enables taxpayers to comply with the regulations of the Internal Revenue Service on expense money. The book, called Melton's Classified Income Tax Record and Travel Expense Book, enables the taxpayer to classify business and personal deductions on separate schedules as they are recorded, thus eliminating back reference to receipts.

Some features of the book include: two pages for every day of the week, shows the city, state and date, with ample space for names and type of entertainment; continuous record of sales, commissions, and expenses; may be audited at a glance; detachable summary pages in duplicate; size is three by five inches; and it comes in two types—weekly and monthly.

Twenty-five weekly books retail at \$2.50, and 12 monthly at \$3.00. They will be available soon in variety and stationery stores or from the company.

Gordon Research Conferences Program

The Gordon Research Conferences were established to stimulate research in universities, research foundations, and industrial laboratories. This purpose is achieved by an informal type of meeting consisting of scheduled lectures and free discussion groups. Sufficient time is available to stimulate informed discussions among the members of a conference. Meetings are held in the morning and in the evening, Monday through Friday, with the exception of Friday evening. The afternoons are available for participation in discussion groups as the individual desires. This type of meeting is a valuable means of disseminating information and ideas which otherwise would not be realized through the normal channels of publication and scientific meetings. In addition, scientists in related fields become acquainted, and valuable associations are formed which result in collaboration and cooperative effort between different laboratories.

Conferences of interest to rubber chemists, physicists and technologists include: elastomers; chemistry of adhesion; and statistics in chemistry and chemical engineering. Detailed programs for 1958 are given below.

Requests for attendance at the Conferences, or for any additional information, should be addressed to W. George Parks, Director, Department of Chemistry, University of Rhode Island, Kingston, R. I. From June 9 to August 29, mail should be addressed to Colby Junior College, New London, N. H.

Elastomers—August 4-8 **Colby Junior College**

E. B. Newton, Research Center,
B. F. Goodrich Co., Brecksville, O.,
Chairman
P. G. Carpenter,
Copolymer Rubber & Chemical Corp.,
Baton Rouge, La.,
Vice Chairman

"Status of the High-Temperature Polymer Program." W. Postelnek, Wright Air Development Center, Wright-Patterson Air Force Base, Dayton, O.

"Mechanico-Chemical Reactions of Polymers." W. F. Watson, The British Rubber Producers' Research Association, Welwyn Garden City, Herts., England.

"Effects of Microstructure on Crystallization Rates of Elastomers." G. S. Trick, The Goodyear Tire & Rubber Co., Akron, O.

"Kinematics of a Rolling Tire and Its Application to Tire Performance." M. Berger, Esso Research & Engineering Co., Linden, N. J.

"The Union of Butyl Rubber with Carbon Black." D. C. Edwards and E. B. Storey, Polymer Corp., Ltd., Sarnia, Ont., Canada.

"Attrition of Carbon Black: Effect on the Carbon Black and on Its Reinforcing Properties in Rubber." A. M. Gessler, Esso Research.

Subject to be announced. G. N. Welding, National College of Rubber Technology, London, England.

"New Vulcanization Studies with Butyl Rubber." R. L. Zapp, Enjay Laboratories, Linden, N. J.

"Perdeuterio SN Rubber." D. Craig, D. E. Diller, R. B. Fowler, F. A. Regenass, E. H. Rowe, W. L. Semon, J. J. Shipman, H. Tucker, Goodrich Research Center.

"Some Aspects of Homogeneous Anionic Polymerization." M. Morton and A. Rembaum, University of Akron, Akron, O.

"The Sorption of Benzene by Natural and Synthetic Polymeric Hydrocarbons." P. Fugassi, Carnegie Institute of Technology, Pittsburgh, Pa.

"The Rheology of Visco-Elastic Materials." M. Mooney, United States Rubber Co., Wayne, N. J.

"Methods of Studying Rubber-Polystyrene Compositions." H. Keskula, J. A. Schmidt, and J. G. Cobler, all of Dow Chemical Co., Midland, Mich.

Chemistry of Adhesion—August 25-29 **New Hampton School,** **New Hampton, N. H.**

G. W. Koehn, Armstrong Cork Co.,
Lancaster, Pa., Chairman
A. A. Marra, Vice Chairman

"Adhesive Properties of Carboxylic Rubbers." H. P. Brown and J. F. Anderson, Goodrich Research Center.

"Adhesion of Fibers to Elastomers." K. R. Williams and H. T. Patterson, E. I. du Pont de Nemours & Co., Inc., Newport, Del.

"Hydrophil Balance Measurements." J. S. Long, University of Louisville, Louisville, Ky.

"Adhesion of Porcelain Enamels-to-Metals High-Temperature Adhesives." B. W. King, Battelle Memorial Institute, Columbus, O.

"Organic Adhesives." F. H. Bair, Wright Air Development Center.

"Ceramic Adhesives." D. G. Bennett, University of Illinois, Urbana, Ill.

"Triazine Compounds." H. H. Levine, Quantum, Inc., Wallingford, Conn.

"Tack." C. A. Dahlquist, Minnesota Mining & Mfg. Co., St. Paul, Minn.

"Role of Cohesive Failure in Adhesive Bonds." T. Alfrey, Dow Chemical.

"Advances in Graft Polymerization." C. E. Schildknecht, Stevens Institute of Technology, Hoboken, N. J.

"Graft Polymerization by Irradiation." D. S. Ballantine and D. J. Metz, Brookhaven National Laboratory, Upton, N. Y.

"Preparation and Properties of Monolayers on Active Metal Surfaces." H. A. Smith, University of Tennessee, Knoxville, Tenn.

Statistics in Chemistry and Chemical Engineering—July 21-25 **New Hampton School**

Frank Wilcoxon,
American Cyanamid Co.,
Pearl River, N. Y. Chairman
Richard DeGray,
Standard Oil of Ohio, Cleveland, O.,
Vice Chairman

"Recent Developments in Ranking Methods." L. Moses, Stanford University, Stanford, Calif.

"The Analysis on an Inter-Laboratory Study." D. Frazier, Standard Oil of Ohio.

"Intra- and Inter-Laboratory Testing: A General Approach." J. Mandel, National Bureau of Standards, Washington, D. C.

"Experiences in the Comparison of Inter-Laboratory Data." W. H. Glancy, General Electric Co., Coshocton, O.

"The Application of Statistics in Scientific Investigation." C. M. Mottley, Charles Pfizer & Co., Brooklyn, N. Y.

"Subjective Testing in Industrial Research." G. E. Ferris, General Foods Research Center, Tarrytown, N. Y.

"Uses and Misuses of Sampling Inspection Plans." A. Stein, Cornell Aeronautical Laboratories, Buffalo, N. Y.

"The Simultaneous Analyses of Multi-Response Designs." H. Smith, Jr., Procter & Gamble Co., Cincinnati, O.

"Application of Balanced Experimental Designs in Industry." H. O. Hartley, Iowa State College, Ames, Iowa.

CIC Division To Meet


The Division of Rubber Chemistry, Chemical Institute of Canada, will hold its annual convention on May 28 at the Royal York Hotel, Toronto, Ont., in conjunction with the three-day convention, May 26-28, of the CIC. Besides the technical sessions morning and afternoon, there will be a Rubber Division luncheon. Tickets for this luncheon can be obtained from C. Croakman, president, Columbian Carbon (Canada), Ltd., 7 Superior Ave., Toronto 14. The afternoon technical session will be followed by a reception, sponsored by the president of the CIC, prior to the banquet of the Chemical Institute.

The morning session will be chair-manned by Wray Cline, of Canadian General Tower, Ltd. The morning papers will be: "Factors Influencing Cut Growth Testing," W. A. Gurney and I. C. Cheetham, Dunlop Research



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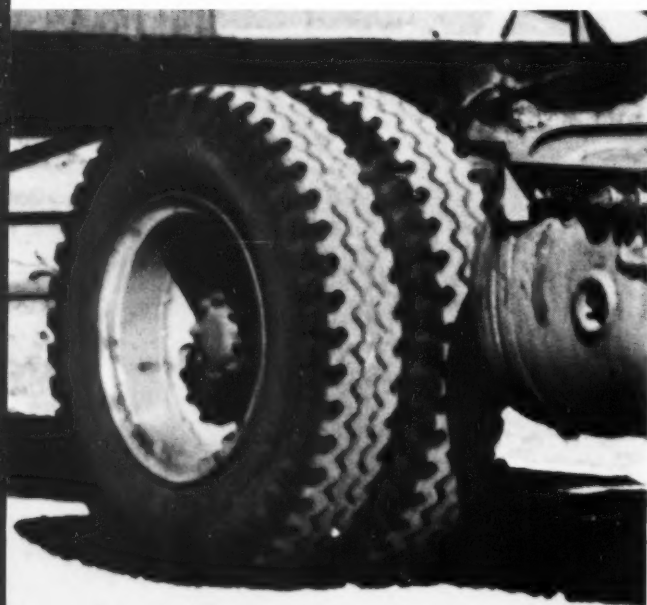
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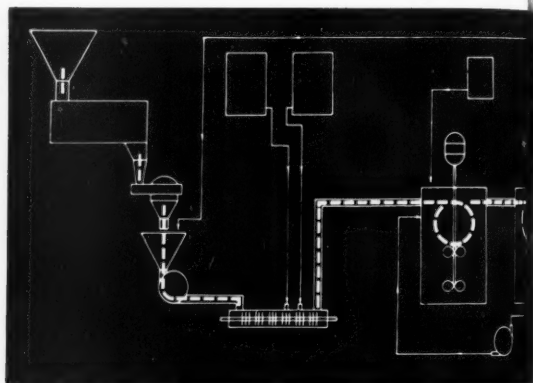
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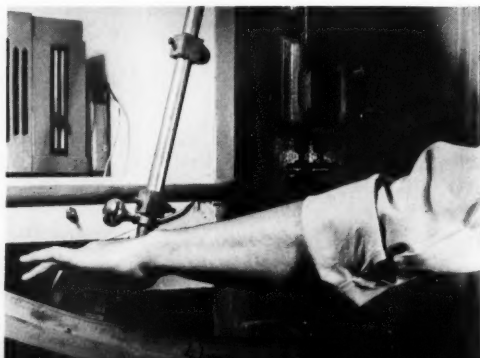


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Sealants Discussed at SAE Annual Meeting

Center (England); "Studies of Synthetic Polymers with the Electron Microscope," W. Rupar and L. Breitman, Polymer Corp., Ltd.; "Some Studies on the Dispersion of Carbon Black in Rubber," C. W. Sweitzer, W. M. Hess, J. E. Callan, Columbian Carbon Co.; "Effects of Radiation on Raw and Vulcanized Elastomers," T. C. Gregson, W. R. Miller, L. B. Bangs, S. D. Gehman, Goodyear Tire & Rubber Co.; "Recent Advances in Rayon Tire Yarn," A. Sandig, Courtaulds (Canada), Ltd.

L. T. Rosser, of Mansfield Rubber (Canada), Ltd., will be the luncheon speaker. The afternoon session, with Wilf Jonah, Louis Specialties, Ltd., in the chair, will include the following papers: "Factors Affecting the Physical Properties of Furnace Black Butyl Rubber Vulcanizates," D. F. Walker, E. M. Dannenberg, B. B. S. T. Boonstra, Godfrey L. Cabot, Inc.; "Lignin-Rubber Technology," D. W. MacGregor, L. H. Krichew, T. R. Griffith, National Research Council, Ottawa; "Maleic Anhydride Modified Elastomers," H. W. Paxton, R. H. Synder, P. F. Gunberg, P. O. Tawney, United States Rubber Co. Research Center; and "The Pneumatic Tire (Yesterday, Today, and Tomorrow)," James E. Corey, Firestone Tire & Rubber Co.

New Salesmen's Group Formed in Akron, O.

The promotion of salesmanship as a profession and the overall development and improvement of the rubber chemical salesman are the aims of the newly formed Rubber Chemical Salesmen's Association of Akron, Inc., Akron, O. Open to anyone selling rubber compounding ingredients, the group plans to achieve these aims by the presentation of prominent speakers, pertinent forums, and the like, at their monthly meetings.

Speakers to date have been C. A. Rische, supervisor of sales training, The Goodyear Tire & Rubber Co., Akron, and S. J. Liedholm, of the Internal Revenue Service.

Officers of the Association elected for a one-year term are: president, E. L. Puskas, Thiokol Chemical Corp.; vice president, F. E. Bell, B. F. Goodrich Chemical Co.; treasurer, D. R. Butt, Standard Oil Co.; and secretary, J. W. Shrontz, Harwick Standard Chemical Co.

Committee chairmen are: membership, W. McCutcheon, J. M. Huber Corp.; program, L. F. Pieroth, Naugatuck Chemical Division, United States Rubber Co.; social, C. M. Wilson, Phillips Chemical Co.; and publicity, G. D. Gingold, Sid Richardson Carbon Co.

The Sheraton-Cadillac and Statler Hotels, Detroit, Mich., were the locale of the 1958 annual meeting (January 13-17) of the Society of Automotive Engineers, Inc.

Among many papers of a more mechanical-engineering flavor, the paper, "The Chemical and Mechanical Development of Elastomeric Piston Seals for Automatic Transmissions," by E. S. Bower and B. C. Vandermar, Western Felt Works, Arcadia Synthetic Products Division, appears to be of interest to rubber compounders.

According to Bower and Vandermar, a satisfactory sealing compound must have the following characteristics: flexibility—sufficient flexibility to seal against piston walls, but rigid enough to resist extrusion between piston and walls; solvent resistance—must resist chemical deterioration of transmission fluids without excessive swelling or shrinking; resistance to temperature extremes—must operate within the range -40 to $+250^{\circ}\text{F}$.; adequate physical properties—must have proper hardness and modulus to seal under deformation, good abrasion resistance, and low compression set; precision forming—must lend itself to molding or other forming techniques such that precise tolerances can be held with freedom from defects that interfere with sealing ability.

The authors initiated their investigation by formulating a "target specification" which they felt sealing compounds must meet. Original physical properties specified were tensile strength of 2,000 psi., elongation of 250%, and Shore hardness of 70 ± 5 . Hardness, volume change, etc.; after immersion in various oils and fluids; compression set after 70

hours at 300°F ., and low-temperature flexing properties; were also specified.

The first satisfactory seals were of NBR (butadiene-acrylonitrile) rubber using a low-sulfur or sulfurless curing system. Swelling and hardness were controlled by type of NBR and the character and the amount of filler and softener incorporated into the mix. Antioxidants were found to reduce aging and heat deterioration.

Later work, Bower and Vandermar stated, has resulted in wide acceptance of polyacrylate-rubber based sealing compounds. Research and evaluations are now being conducted on compounds which are based on fluorocarbon elastomers.

After an experimental compound has passed the "target specification," seals are fabricated and field-tested in the automatic transmissions for which they were designed. At the end of this service test-period, the transmissions are torn down, and the seals examined for "tearing, cracking, extrusion, or any other evidence of physical breakdown or fatigue."

The authors have devised a simulated service test for batch-to-batch control of transmission seals. This test consists of "immersing a seal section in ASTM #1 oil for a period of time at a given temperature. At the end of this time the seal is bent radially over a 1" mandrel. If cracks appear in the outer periphery of the lip section, the compound is considered unsatisfactory.

Besides the rubber compounding aspects of automatic transmission seal production, the authors went on to discuss the purely mechanical development of the lip-type seal.

Peroxides Topic of Northeastern Section Meeting

The March 13 meeting of the Elastomer & Plastics Group, Northeastern Section, ACS, held at Massachusetts Institute of Technology, Cambridge, Mass., and jointly sponsored with the Northeastern Section, consisted of a symposium in the afternoon on "Organic Peroxides," with Professor N. A. Milas, MIT, as moderator. The three speakers were: R. B. Mesrobian, Continental Can Co., discussing "Organic Peroxides—Their Structural Classification and Mechanisms of Decompositions"; E. D. Crittenden, Hercules Powder Co., dealing with "Industrial Uses and the Structure of Certain Organic Peroxides"; and O. L. Mageli, Lucidol division, Wallace & Tiernan Corp., speaking on "Correlation of Organic Peroxides—Half-Life Data and Polymerization Studies." In attendance were 150 members and guests.

Peroxide Symposium

Dr. Mesrobian described the broad classes of peroxides and hydroperoxides, their preparation by various means, and their decomposition rates as controlled by free-radical, ionic, stereospecific, and displacement reactions.

Dr. Crittenden discussed the structure and industrial uses of peroxides and hydroperoxides, specifically Hercules dicumyl peroxide (Dicup) in its several forms. The advantage of cumyl oxyreactions is that they are not influenced by the presence of inhibitors, including the effects of accelerators and other rubber chemicals and similar materials frequently present in industrial applications.

The major use of these peroxides is in the production of phenol, throughout the world, at the rate of 100 mil-

lion pounds per year, this speaker said.

He continued with a discussion of the initiation of Dicum decomposition temperature, the use of metallic promoters or activators, the pot life of compounded mixtures, and the uses of Dicum in emulsion polymerization of styrene-butadiene elastomers, in potting and molding polyester resin compounds, and in superior aging elastomer compounds, where it has been used with almost all elastomers except Thiokol polysulfide rubber.

Best product properties were secured with the use of a little sulfur and accelerator in addition to the Dicum. Typical formulations were shown. Superior compression set results in black nitrile and Vyram stocks were secured.

Dicum-cross-linked polyethylene exhibited very high tensile strength, but less than 1% Dicum should be used for extruded compounds. Dr. Crittenden concluded his remarks with the mention of the use of cumene hydroperoxide in the styrenation of alkyds.

Dr. Mageli discussed the methods of his colleagues and himself in determining the half-life of various peroxides in polymerization systems, employing procedures discussed before the thirteenth annual meeting of the Society of the Plastics Industry at Edgewater Beach Hotel, Chicago, Ill., in February.

Polymer Chemistry

Following a dinner attended by 130 in the Graduate House of MIT, in honor of the speakers, the combined groups met in Huntington Hall, MIT at 8:00 p.m., with H. Reynolds, Dewey & Almy

division of W. R. Grace Co., in the chair, to hear Maurice Morton, University of Akron, speak on "A Decade of Advances in Polymer Chemistry." There were 350 present.

Dr. Morton's talk was divided in two sections: first he described what he called striking theoretical advances in knowledge about macromolecules, and then he considered practical advances that had given rise to new classes of elastomers of unusual properties.

In discussing the theoretical developments, he paid high tribute to the technique of Melville and others in perfecting the rotating sector method of radical life measurement in emulsion and other types of polymerization. The three most important advances in theory, in his opinion, were this development in radical polymerization kinetics, the use of infrared spectroscopy in structure determinations, and the development of a basic theory of dilute solution viscosity.

In his consideration of practical advances in polymer chemistry during the past ten years, Dr. Morton mentioned epoxy resins, polypropylene and polybutylene oxides, polyformaldehyde, polycarbonates, etc., but he particularly stressed the development of fluorinated polymers, silicone rubbers, and urethane polymers.

He concluded his remarks with a discussion of stereospecific polymers, showing how a knowledge of the properties of some of the isotactic polymers of 1-olefins had led to the synthetic production of *Hevea* rubber and cis-1,4-polybutadiene and opened up the possibilities of new discoveries in the stereochemistry of coordinate bonding and valence bonds in general.

"A Study of the Impact Resistance of Rayon and Nylon Tire Cords." Conventional laboratory testing of tire cords is at low rates of strain; the usual time for completing a break is in the order of 18 seconds.

Parker and Kemic describe two machines whereby cord breaks are completed in only a few milliseconds. One model is a ballistic pendulum type; the other is a rotating flywheel with a pin on its edge to engage and break the test cord. In both cases the load-elongation curve is displayed on a cathode-ray oscilloscope. The flywheel device also permits the total energy of breaking to be determined.

"In general," according to the authors, "the total elongation of tire cord is reduced and the breaking strengths increased as the rate of strain is increased. Nylon cords are characterized by a particularly marked reduction in elongation with the result that the total breaking energy drops sharply. Rayon cords show a significant increase in total energy absorbed, as a result of increased modulus and breaking load."

In addition to laboratory impact tests, Parker and Kemic report the results of actual tire tests where tires were driven over a six-inch curbstone at 20, 40, and 60 mph.

"Careful inspection and testing of the cords in the area of impact failed to reveal," the authors stated, "any perceptible damage or loss in cord properties in either rayon or nylon tires."

"Some Observations of the Comparative Performance of Rayon and Nylon Passenger Tires." Screening trials on passenger tires constructed from 1250 denier super-super rayon and standard nylon and possessing similar carcass strengths were reported by Douglas and Farrell. The tests were carried out in Texas and Canada under high speed and normal passenger driving conditions.

"The low growth, low rate of wear, lower running temperatures and improved high-speed performance indicate," the authors state, "the advantages to be gained in using the low denier rayon construction in passenger tires."

Douglas and Farrell also discussed the potential of these super-super rayons in truck and high-speed tires.

Rayon Institute Holds Technical Symposium

Tire Town (Akron, O.) was the scene of a "Technical Symposium on Rayon Tire Yarn Progress," held January 23 by the American Rayon Institute, Inc.

The program included papers by A. B. Baker, American Viscose Corp.; A. Sandig, Courtaulds (Canada), Ltd.; J. P. Parker and S. Kemic (paper presented by F. B. Breazeale), American Enka Corp.; and H. W. Douglas and G. A. Farrell, Courtaulds.

Abstracts of these papers follow:

"Noise Level Study of Nylon and Rayon Passenger Tires." Tests were conducted, Mr. Baker reported, to determine levels of noise resulting from the use of nylon and rayon passenger tires. It was found that nylon tires produced noises from 10 to 33% louder than those produced by rayon ones. When actual noise levels were converted to intensity it was found, according to this speaker, that the differences ran

from 1.2 to 4.3 times as high for nylon as for rayon under identical circumstances. All data were collected in the frequency range common to normal speech (300 to 4800 cps.).

"Recent Advances in Rayon Tire Yarn." Development of improved, super, super-super, and "new rayon" tire yarns was discussed by Mr. Sandig. The outstanding tensile strength and fatigue resistance of the "new rayons" were described, and "the possible application of their properties for making better and more economical rayon tires" was suggested.

This recent progress in rayon tire yarn is due to the intensive research in spinning technology and the fine-structure of cellulose and regenerated cellulose fibers.

Mr. Sandig closed his talk with a discussion of the relations between mechanical properties and fiber fine-structure parameters.

Plan Skid Conference

An International Skid Prevention Conference of engineers and other scientists will be held next September in Charlottesville, Va., according to the University of Virginia. Purpose of the Conference will be to organize on a worldwide basis a coordinated program on the problem of traction between the vehicle and the road.

T. E. Shelburne, director of the Virginia Council of Highway Investigation & Research, is chairman of a conference steering committee, composed of representatives of government, industry, and research agencies.

Industry members of the committee include K. A. Stonex, research engineer, and W. F. Sherman, engineering and technical department, of the Automobile Manufacturers Association; J. B. Hulse, managing director, Truck Trailers Manufacturing Association; J. H. Cox, Tire & Rim Association, Inc.; G. Flint, tire manufacturing division, The Rubber Manufacturers Association, Inc.; A. T. Goldbeck, engineering consultant, National Crushed Stone Association;

R. G. Wilcox, Portland Cement Association; and D. D. Woodson, Asphalt Institute.

Mr. Shelburne has issued a call for technical men throughout the world to communicate with him at the University of Virginia if they have research findings which could be of value to the Conference.

The Conference program being organized will provide a forum for discussion of vehicle dynamics, the influence of the tire, the effect of the driver, and the effect of the road surface on traction. Studies will be made of the accuracy of skidding accident statistics and of various methods now used to test road surface friction.

the microscope still remains as the indispensable means of study and control. The total amount of dip impregnating a cord may be determined on an analytical balance, but the degree of impregnation and the distribution of the dip can be determined only with the microscope. In this talk many similar examples were described and illustrated which indicate the value of the direct and accurate information provided by microscopic methods.

The officers for 1958 and Dr. Allen are shown in the accompanying photograph.

The next meeting of the Group will be held on May 23 at Manero's Restaurant.

Connecticut RG Hears Allen on Microscopy



Connecticut Group officers and speaker (left to right): W. H. Couch, vice chairman; R. T. Zimmerman, chairman; R. P. Allen, guest speaker; V. P. Chadwick, secretary; and J. W. Perkins, treasurer

The Connecticut Rubber Group's technical meeting held at Manero's Restaurant at Orange, Conn., February 21, was attended by 126 members and guests. Business transacted included the introduction of 1958 officers to the body and the reading of the treasurer's report. At the meeting R. P. Allen, consultant in industrial microscopy, talked on "Technical Microscopy in the Rubber Industry," illustrating the talk with slides. A summary of Dr. Allen's lecture follows.

In the rubber industry one ordinarily considers the microscope as useful only in the examination of the size and the shape of pigment particles and in the study of the dispersion of carbon black. Less well known are those applications of microscopic methods which provide the clues, in a unique fashion, which lead directly to the answer to a problem. In many cases the problem is otherwise insolvable. Everyone has had the experience of let's wait and the

problem will solve itself; microscopic methods reduce the number of such instances.

For example, a certain gasket showed excessive porosity. Under the microscope the pores were found to contain small particles identified as wax. This poorly dispersed wax was carrying a small amount of water on to the stock, which produced pores during cure. The use of a different wax eliminated the trouble.

The tube of a rubber hose developed delaminations. Was the cause butyl contamination or other foreign material? Microscopic methods showed not only that the delamination was caused by a mixture of stocks; it was even possible to identify the foreign rubber stock. This type of exact information makes it less possible for the same trouble to occur again.

Over a period of years the ideas about the optimum impregnation of a tire cord or a belt cord have changed, but

To Exchange Data

Association of Consulting Chemists & Chemical Engineers, Inc., for furtherance of world-wide exchange of technological information, invites consulting chemists and chemical engineers of all free countries to write to the Association regarding problems requiring American technology and regarding new or pending technological developments in their own country. The Association will direct such correspondence to the proper channels, and reciprocal actions may be expected from the Association's members. Correspondence in English and on letterheads should be addressed to the Association, attention of Miss A. B. Bowers, director of publicity, 50 E. 41st St., Room 82, New York 17, N. Y.

Gates New Coatings

Gates Engineering Co., Wilmington, Del., has announced three additional new products to its extensive line of protective coatings—a hot spray vinyl, a Hypalon¹ liquid coating, and a new formulation of its neoprene maintenance coating.

The hot spray vinyl is a high solids coating that allows deposit of a heavy quick-drying film with little overspray and excellent edge build-up resistance to sagging. The bright-colored Hypalon coatings, claims the firm, resist strong oxidizing agents and acids, show unusually good flex-life, and will not alligator or crack after application and exposure. The manufacturer also said that its neoprene maintenance coating can be hot sprayed, and that brushability, color stability, and wrinkling which are associated with recoating have been greatly improved.

¹E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., chlorosulfonated polyethylene.

WASHINGTON

REPORT

By JOHN F. KING

ODM Decision on Stockpile by July; Congressional Action Late in 1958

The government's mobilization planners are busy streamlining national stockpile policy to reflect post-Sputnik defense efforts. The various departments of the executive branch are currently submitting their comments on the findings of the Pettibone Report¹ on the defense stockpile. At the same time, more specialized services of the Business & Defense Services Administration, the Federal Civil Defense Agency, the Interior Department, and the Office of Defense Mobilization are surveying mobilization needs of ready-to-use products, including a variety of rubber goods, that would be required by both military and civilian populations in event of nuclear attack.

ODM July Decision?

Official government reaction to the Pettibone Report—which urged liquidation of substantial quantities of stocked materials in recognition of a shorter war than was envisioned when stockpiling began a decade back—should be completed by the end of April. ODM's staff will evaluate departmental comments, pointing out areas of agreement and disagreement on the Pettibone recommendations, and report the "sense" of the executive branch to Defense Mobilizer Gordon Gray. With the help of further advice from the Cabinet-level Defense Mobilization Board, Gray presumably will be in a position to make his final recommendations to President Eisenhower.

While this whole process should take another three months—Gray hopes to start making decisions on new stockpile policy by July—it is almost a foregone conclusion that the upshot will be a recommendation to Congress for greater powers to dispose of overstocked goods in the government's \$7-billion defense warehouse. Included in the stockpile are 1.2-million tons of natural rubber.

Because ODM's tentative timetable calls for "action" by July, it is reasonable to assume there will be no recommendations to the present Congress. About the time Mr. Gray is

framing his decision, Congress will be preparing to adjourn.

In spelling out this timetable, and emphasizing its "tentative" nature, government officials indicate that the one single finding of the Pettibone Report on which there is—so far—the greatest degree of governmental agreement is the recommendation for disposal of certain stocks. Though there were no specifications in the Report, it is widely interpreted as urging, in the case of rubber stocks, a reduction of at least 40% in the total rubber now in government warehouses.

Finished Product Requirements

While the wheels of government grind slowly toward a decision on the Pettibone Report, more wheels began turning on a new "supply requirements" study of finished products that would be needed immediately after a nuclear attack.

ODM has announced that BDSA, FCDA, and the Departments of Agriculture and Health, Education & Welfare are surveying manufacturers' capacity to produce 90 "survival" items required in six major areas: (1) medical and health, (2) food, (3) body protection, (4) housing, (5) sanitation, and (6) power and fuels.

The surveys are to determine which

required products in these areas would be critically short in an emergency. When this question is answered, the question to be solved on a higher level is how will the anticipated deficits be overcome. In line with present thinking, it is thought that where key deficits are expected, FCDA would seek new money from Congress to stock the items in question. Where this remedy is found burdensome or too complicated, then tax benefits or even a modicum of outright government assistance would be made to companies producing the items needed.

It is hoped, however, that cooperation from industry will be forthcoming whereby companies would voluntarily maintain heavier-than-usual inventories at dispersed, yet handy locations. These would be available to both military and civilian authorities on a moment's notice.

Most rubber products the planners believe warrant the rating of an "item essential for survival" are listed in the medical, health and body protection categories. They include: surgical and industrial gloves; blood donor and recipient sets; blood tubing; adhesive plasters; surgical stockinette; drains; tubes; textile webbing; catheters; surgical aprons; rubber and plastic tubing; waterproof outer garments; footwear; and nipples. Also, in the power and fuels category are included, rubber components such as hose and other fire protection equipment, collapsible storage tanks, and protective clothing.

Disposal of Louisville Alcohol-Butadiene Plant Now Possible, But Market Not Good

The last legal obstacle to the disposal of the government's alcohol-butadiene plant at Louisville has now been removed, but actual sale of the plant appears about as remote a possibility as it ever was. Publicker Industries' lease on the \$40-million rubber-component producing facility expired April 4, and technically the government may go ahead and sell it after May 4. But officials familiar with the long drawn-out wrangle over disposal of the Louisville plant point to the economic recession as a new bar to sale of the installation.

Disposal Chances Now Poor

"With the economic uncertainties that exist, what sort of bids could you expect on an industrial property like Louisville?" asks one official.

He concedes the government is eager to sell the plant—upkeep alone is costing GSA well over a quarter million dollars a year. But he makes it clear Uncle Sam doesn't want to take a beating on price. With March forecasts on the health of the economy not the hopeful picture the Administration said earlier in the year it expected by

¹RUBBER WORLD, Mar., 1958, p. 893.

springtime, the prospects for a "decent break" on a bid from industry for Louisville "seem a little way off yet," the official said.

Comparing the Louisville sale situation with government efforts to sell off some of its other war-born industrial installations—such as the Nicaro nickel plant in Cuba—the official pointed out that General Services Administrator Franklin G. Floete recently told Congressional appropriation committees that "now's the worst time" to undertake disposal.

Even though the government will be "stuck" with the 90,000-ton-capacity alcohol-butadiene plant without an industry buyer, the official made it plain there will be no renewal of Publicker's lease. Federal facilities disposal statutes impose such onerous burdens on both the government-lessor and the industry-lessee that neither party would care to tie himself up again with an inoperative plant.

The official says that since the general economic downturn caught hold late in 1957, "we haven't been doing much in the way of specific planning for disposing of Louisville." He ruefully observed that the current poor prospects for getting rid of the plant contrast sharply with the rosy situation which existed last summer.

1957 Disposal Failed

At that time Federal Facilities Corp. Chief Laurence B. Robbins was con-

fidently telling the Senate Banking & Currency Committee that passage of the then-pending Vinson Bill would permit a "prompt" sale. "The Corporation," Robbins continued, "has received a sizable number of expressions of interest from companies" in addition to firm bids filed earlier by other chemical and rubber firms. Robbins said that if the prohibition against sale of Louisville before April, 1958, were lifted, "it is logical to believe that the government can secure a price . . . better than the previous bids."

The FFC administrator also made something of a long-range prophecy. He said that if the government sale could proceed without further delay, it also was "logical" that it could demand a better price "than at some indefinite future date."

AS RUBBER WORLD readers know, the Vinson Bill which would have cleared the tracks for Mr. Robbins' plans was derailed by the combined efforts of Publicker and the Senate farm bloc. The company and the Senators managed to interject the agricultural surplus question into the Louisville disposal program—arguing that the plant could be used to siphon off huge amounts of CCC farm stocks for processing in alcohol-butadiene. While this plan was squelched by a tough-worded Administration rejection, Senate consideration of it was strung out long enough so that Congress adjourned without acting on the Vinson Bill. The Bill was never voted out of the Senate Banking & Currency Committee.

Marketing Legislation Delayed Until Summer; S-11 and S-3079 Bills Making Slow Progress

Prospects for enactment of a major piece of legislation that has sharply split the rubber industry dimmed perceptibly in March. The Supreme Court's January decision in the Standard Oil of Indiana case, the U. S. Chamber of Commerce's overwhelming vote against it, and a growing wariness in both the Senate and House that perhaps, after all, S-11 may not be "good" legislation, have all combined to put the so-called "Good Faith" bill into deep freeze. The bill is supported by rubber product marketers, opposed by the manufacturers.

"Good Faith" Bill Status

After a year of legislative maneuvering, this is the situation faced by the bill that would specifically limit the defense of "good-faith" in price discrimination suits brought under the anti-trust laws:

- The House will not touch it until it passes the Senate, despite the continuing efforts of Rep. Wright Patman (Dem., Tex.) to ram it through to a vote.

- The Senate itself is taking a more neutral position on the bill while its Judiciary Committee settles the wrangle over the bill that has gone on for months.

In the Senate Judiciary Committee, proponents of S-11 seem in March to have lost ground. The panel met twice during the month and finally agreed that before the bill is voted out to the Senate floor for a vote, it will consider the "mystery" amendment of Sen. Everett M. Dirksen (Rep., Ill.). Dirksen has been carrying his amendment around in his pocket for weeks now, and still the S-11 proponents, led by Sen. Estes Kefauver, chairman of the Anti-trust Subcommittee, don't know what it is. The Kefauver faction, however, is confident that the Dirksen amendment is not good news; that more than likely, it will have the effect of emasculating the "Good Faith" bill.

Compounding the proponents' headaches is the prospect of having to deal with other amendments to the "Good Faith" bill that are circulating on Capitol Hill. Subcommittee member Homer Capehart (Rep., Ind.), for in-

stance, would restrict application of the legislation to the food-drug-cosmetic field. Some legal experts argue, however, that this would be unconstitutional.

S-3079 on Price Cutting

While the Senate Judiciary Committee grapples with S-11, another piece of legislation that follows the same pattern of "small vs. big business," as in the "Good Faith" bill, has popped up. More than likely destined to cause new differences between rubber manufacturers and distributors, S-3079 has strong bipartisan backing, being co-sponsored by Democratic Sens. John Sparkman (Ala.), Hubert H. Humphrey (Minn.), Wayne Morse (Oreg.), Joseph C. O'Mahoney (Wyo.), Lister Hill (Ala.), and Ralph Yarborough (Tex.), and Republican Sens. Edward Thye (Minn.) and Jacob K. Javits (N. Y.).

S-3079 would have the effect of making "private enforcement" of the anti-trust laws the official policy of the Federal Government and would, according to its sponsors, offer "practical" protection to small businessmen victimized by predatory pricing practices. Specifically, the bill would make Section 3 of the Robinson-Patman Act, which is a general prohibition against price-cutting to eliminate competition, a part of the anti-trust statutes. Section 3 is not now enforceable because of the Supreme Court decision in the *Carnation Milk-Safeway* case, in which it was held that the provision was not available to private parties who want to sue for treble damages.

The Humphrey Subcommittee on Retailing, Distribution and Fair Trade Practices of the Senate Small Business Committee held two days of hearings on S-3079 in March. Following the hearings—in which all witnesses including Assistant Attorney General Victor Hansen and Federal Trade Commission Chairman John Gwynne supported the bill—Chairman Sparkman of the Small Business Committee asked the Senate Judiciary Committee to hold hearings on the bill. The Small Business Committee does not initiate legislation as such; so Judiciary would have to act on the bill.

Sparkman, in a March 15 letter to Anti-trust Subcommittee Chairman Kefauver, urged "early consideration" of S-3079 so that "effective, economical, and expeditious means of anti-trust enforcement by small business" can be approved by the Senate this year.

RMA, NTDR Positions

Neither The Rubber Manufacturers Association, Inc., nor the National Tire Dealers & Retreaders Association, contestants in the S-11 arena, have a policy spelled out yet on S-3079. But spokesmen for both organizations privately report that if the bill gets rolling on the legislation, they will again line up against each other.

NTDRA spokesmen meanwhile report they are still plugging for hearings by the Humphrey Subcommittee on tire manufacturer marketing practices. While on the Subcommittee's agenda for 1958, the marketing practice probe may never get off the ground because of Chairman Humphrey's preoccupation with alleged mal-practices in the food retailing industry. Independent tire dealers, however, are hopeful a subcommittee cochairman—in this instance, Sen. Russell B. Long (Dem., La.)—can move in and get hearings

going by early summer.

In conferences with the subcommittee, the independents have stressed that "the" marketing problem they want fully aired is the "direct-selling" issue. The dealers have complained that direct purchase arrangements between big trucking companies and rubber manufacturers are "hurting" independents who normally would handle the business. Moreover, the independents see in direct-sales arrangements with truckers an entering wedge in the bus, taxi, and rent-a-car markets.

Sadlak Footwear Tariff Bill Passage Likely; Technicality Favoring Imports To Be Removed

The latest efforts of Rep. Antoni Sadlak (Rep., Conn.) to plug loopholes in the rubber-soled footwear tariff seem destined for success, although Congressional approval of the Sadlak bill (HR 9291) probably will not go off without a hitch. Footwear importers, who over the years have demonstrated a rare ingenuity for tariff avoidance, believe they have strong arguments to derail the legislation. They contend that Congress has no business delving into technical tariff matters at this time, since the Tariff Commission presently is involved in an overhaul of existing tariff schedules. The issue should be settled by tariff technicians, the importers hold, and not by a harried Congress.

HR 9291 Closes Loopholes

But Sadlak and the RMA Rubber Footwear Division have more than arguments—they have the legislative ball rolling in their favor. The tariff-writing House Ways & Means Committee in February unanimously voted to report the Sadlak bill. In its March 13 formal report on the legislation, the Committee recited the history of the domestic footwear industry's efforts to keep one jump ahead of the importers and pointed out that with the blessing of the Departments of State and Treasury, HR 9291 will "further close these loopholes in our tariff structure."

Before the bill got to the House floor, however, Rep. Ludwig Teller (Dem., N. Y.) served notice he would oppose it. This precludes the possibility of getting the legislation past the House by unanimous consent; it also means Sadlak and the Ways & Means Committee may face delays that would result from having to go to the Rules Committee for prior approval to bring

the bill to the floor. Sadlak believes that it is still possible to win House approval without the formality of a Rules Committee okay. He believes Teller can object all he wants, but that the House would uphold Sadlak in suspending the rules and immediately clearing the bill for Senate action.

Rubber vs. Rubber-Leather

The Sadlak bill, introduced late last session, would require many types of rubber footwear now entering Customs at duties of 10-20% of their "foreign value" to be dutied at 20% of their American selling price. Importers manage to avoid the stiffer American-selling-price-based levies by superimposing leather pieces on the upper part of the shoe. This practice has the effect of gaining for the product the distinction of being "in chief value leather" and hence not subject to the American selling price principle that applies to "rubber" footwear.

The use of leather eyelets, tongues, etc., on the uppers was developed after legislation in 1954 (Public Law 479) closed a popular loophole. Prior to enactment of PL 479, the importers avoided the American selling price barrier by bringing in rubber footwear that had a strip of "filler" leather in the sole. This, too, had the effect of bypassing the U. S.-price principle, formulated in 1933 by Presidential Proclamation.

While Sadlak, a Ways & Means Committee member, maneuvers the latest loophole closer through Congress, both importers and domestic producers agree that imports at which the legislation is aimed are pouring into the country in record volume as spring buying begins.

union-member groups representing the industry were scheduled to arrive for April visits under the national organization's short-course on Federal Government functions. The briefings, directed by URWA general secretary-treasurer, Desmond Walker, cover all aspects of governmental activity from unemployment compensation to foreign policy. According to URWA's announcement, the programs feature "political science for breakfast, lunch, and dinner" at a 14-hour-day pace. Specifically, this meant visits to the Capitol, the White House, AFL-CIO headquarters here, and, as a fillip, the Moroccan Embassy.

Ayres Comments

The mid-March visit of the union group gave Akron's Congressman, Rep. William H. Ayres, a prime opportunity, which he took, to needle the URWA's national leadership. Ayres has conducted a running feud with union leaders although he claims the support of URWA's rank-and-file. Ayres went after URWA's "leadership" from the floor of the House for not supporting his efforts to get the House Labor Committee to air the mutual management-labor recriminations that have grown out of the two-year-old URWA strike of the O'Sullivan Rubber Co. plant at Winchester, Va.

After the URWA walkout at this plant, the company brought in unorganized labor and then had the URWA decertified as a bargaining agent through an NLRB election in which striking URWA members did not vote. The case brought to the forefront of URWA thinking the belief that the Taft-Hartley Act, which permits the exclusion of "economic strikers" from voting in decertification elections, must be revised. Although both President Eisenhower and Labor Secretary Mitchell have urged such amendment, and organized labor is staunchly for it, URWA is not anxious to use the O'Sullivan dispute, publicly aired, as a means of carrying the amendment off. Pro-labor Congressmen agree that the Winchester issue, if publicly aired, might produce results that would hurt labor more than they could possibly help with labor-favored amendments to the Taft-Hartley Act.

Against this by-play the Perkins subcommittee of House Labor, which Ayres and other Republicans have been pressing to hold hearings on the O'Sullivan dispute, announced it would not do so at present. There was an indication that hearings would be held "some time after the Easter recess" which ended April 10, but this is not believed likely.

Ayres also seized on the delegation's visit to razz URWA leaders for not scheduling, as part of the visitors' itinerary, a visit to Akron's own Congressman. Ten of the 29 members of the group were Akronites.

URWA's "Legislative Institute" Draws Comment From Akron's Republican Congressman Ayres

Twenty-nine United Rubber Workers (AFL-CIO) union members formed the first contingent from rubber labor to

spend a week in Washington in mid-March under the URWA's 1958 "Legislative Institutes" program. Two other

Panel Agenda

The panel's tour included briefings from URWA and AFL-CIO chieftains on political education and fund-raising; labor-management issues, including widely publicized corruption charges and counter-charges; federal aid in the social welfare fields; and foreign policy. Featured speakers were former Secretary of State Dean Acheson, Democratic Sens. William Proxmire (Wis.) and Ralph Yarborough (Tex.), and Democratic Reps. Frank Thompson (N. J.) and Lee Metcalf (Mont.).

April 15 Tire Ad Guide

The Federal Trade Commission's Bureau of Consultation is shooting for April 15 to finalize its guide for "truthful and meaningful tire advertising." Charles E. Grandey informed RUBBER WORLD in mid-March that "we hope it isn't too many weeks before we submit a final draft of the guide for consideration of the Commissioners." Grandey is Consultation Bureau director.

He said that he "had hoped to have it in my hands, finished, by the middle of this month, but we received a lot more comment than we expected" from the manufacturing and distributing segments of the industry. Industry comment was requested by Grandey's staff last November on an 11-point advertising code of ethics that FTC calls a "major step" toward eliminating deceptive tire promotion. The key guideline would bar advertising based on non-existent quality standards.

Speaking of industry reaction his Bureau has received so far, Grandey said that there has been a "relatively small area of dispute" between manufacturers and marketers over the proposed regulations. He conceded that what differences have shown up touch on the "important points" in the guide.

"We're working continuously on these disputed points," Grandey declared. "But we can't tell with precision how long we'll be at it, or how long the Commissioners will take before finalizing it. I don't believe it will be long."

While Grandey would not state that the Bureau has set the April 15 deadline for completion of its study, other informants reported the agency was working hard to meet that date with a finished report. It was noted that the industry is eager to have the rules spelled out prior to the spring-summer selling seasons.

Hercules Powder Co., Wilmington, Del., has announced a 4¢-a-pound reduction in the base price of its high-density polyethylene, Hi-fax. The new base price is 43¢ a pound.

INDUSTRY

NEWS

Du Pont Speeds "Viton"¹ Production



Willard Stewart, Inc.

Products fabricated from Du Pont's "Viton"

"Viton," latest addition to the elastomer family of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., will be available in commercial quantities this month. The new Du Pont elastomer plant, at Deepwater Point, N. J., was scheduled to "come on stream" some time during the first week of April.

"Viton" is a linear copolymer of hexafluoropropylene and vinylidene fluoride and contains about 65% fluorine by weight. It is characterized by

having excellent solvent resistance at high temperatures. The new copolymer has been in pilot-plant production since 1956, and full-scale field testing and evaluation have been carried out through 1957.

"Viton" is expensive, however; the price tag reads \$15 per pound.

To date the largest single use of "Viton" has been for aircraft seals. Another interesting application is its use as valve-stem seals on Ford's new super-duty truck engines. These engines employ sodium-cooled exhaust valves which cause extremely high tempera-

¹RUBBER WORLD, Nov., 1957, p. 250.

SOLVENT RESISTANCE

Solvent	Tensile Strength Retained %	Elongation Retained %	Volume Increase %
JP-5* Aircraft fuel, 75° F.	100	100	0.4
JP-4* Aircraft fuel, 75° F.	97	100	0.8
ASTM #3 oil, 300° F.	95	100	4.3
Benzene, 75° F.	73	92	19.6
OS-45† Silicate ester, 400° F.	62	67	11.1

*Air Force jet engine fuel.

†Monsanto Chemical Co., St. Louis, Mo.

tures at the valve stem seal.

A brief summary of "Viton's" chemical and physical properties appear in the accompanying tabulations.

AIR OVEN AGING: "Viton" vulcanizates remain usefully elastic for: more than 2,400 hours at 400° F.; more than 1,000 hours at 450° F.; more than 250 hours at 500° F.; more than 72 hours at 550° F.; more than 24 hours at 600° F.

PROPERTIES OF "VITON"

Tensile strength	2000-3000 psi.
Hot tensile strength (300° F.)	300-1000 psi.
Elongation	100-400%
Hot elongation (300° F.)	80-200%
Compression set (25% compression, 70 hrs. at 250° F.)	90-97% recovery
Brittle point (0.075-in. thick specimen)	-47° F.
Young's modulus (at -20° F.)	10,000 psi.

RMA Molded, Extruded, Lathe-Cut, Sponge Rubber Products Specification Handbook Out

The Rubber Manufacturers Association, Inc., began distribution on April 1 of about 11,000 copies of its new engineering data handbook on molded, extruded, lathe cut, and chemically blown sponge rubber products. It is entitled "Rubber Handbook—Specifications for Rubber Products—Molded, Extruded, Lathe-Cut, Chemically Blown Sponge," and single copies at \$1 each may be obtained from the RMA, 444 Madison Ave., New York 22, N. Y.

Two years in preparation¹, the 52-page illustrated manual is designed primarily to aid the engineering and purchasing departments of the industry's customers in improving specifications for rubber component requirements. The handbook is the work of a co-operative educational committee of the molded, extruded, lathe-cut, and chemically blown sponge subdivision of the RMA's mechanical goods division.

The committee was headed by H. C. Dinmore, Tyer Rubber Co., with J. H. Gerstenmaier, Goodyear Tire & Rubber Co., chairman of the subcommittee on molded goods; C. L. Shreiner, Sr., Chardon Rubber Co., subcommittee chairman on extruded goods; H. W. Osborn, Stalwart Rubber Co., subcommittee chairman on lathe-cut goods; and G. R. Sprague, Sponge Products Division, The B. F. Goodrich Co., subcommittee chairman on chemically blown sponge. Special tribute goes to R. G. Ruby, Acushnet Process Co., and

C. C. Miller, RMA staff, for their work in editing the handbook.

Inasmuch as manufacturing techniques, capabilities, limitations, and processing problems are different for each class of product, the molded, extruded, lathe-cut, and chemically blown sponge items are each treated in separate chapters, each with its own charts, tables, illustrations, and definitions.

It is the belief and hope of the technical committees responsible for this handbook that its widespread use by rubber industry customers will lead to better understanding among their engineering, purchasing, inspection, and quality control departments and the technical, production, and accounting departments of the rubber products manufacturers. To the extent that the handbook may help customers avoid "over-specification" in terms of such things as dimensional tolerances, trim, flash extension, appearance, load deflection, strength of bond or splices, etc., the handbook could operate to help them reduce costs.

The handbook is dedicated by the committees to the memory of the late J. J. Catterall, who, as executive secretary of the RMA mechanical rubber goods division, devoted much time over the past two years to coordinating the work on the project.

¹RUBBER WORLD, Aug., 1956, p. 727; Sept., 1957, p. 853.

Avon Lake, O., in tonnage quantities for large-scale tests. It has undergone extensive testing as a complete replacement for natural rubber in the tread and carcass stocks of heavy-duty truck and bus tires. On indoor wheel tests of 16 heavy-duty express tires (11.00 by 20) the heat build-up in Ameripol SN tires was less than in *Hevea* rubber control tires. The mileages run by the synthetic tires were comparable to those run by natural rubber tires. Resistance to cut growth was better in the Ameripol SN tires.

Ten Ameripol SN tires placed in intercity high-speed bus service were all sound after an accumulation of 600,000 miles of travel to the time of regrooving the treads. The results of tests made on the synthetic truck and bus tires showed a total of more than two-million miles run on 29 mileage account tires, none of which failed in service.

Army Ordnance tests of military tires showed that Ameripol SN tires met or surpassed all military requirements and were superior to standard military truck tires in tread wear, tire life, tread cutting resistance, and tread splice.

It was reported that foreign nations are showing great interest in the production of SN rubber since information about the synthetic rubber became generally known through publications and patents. In Russia, SKI, synthetic rubber—isoprene—is already being produced and tested on an extensive basis.

As to the cost of the new material, it was believed that Ameripol SN can be marketed at a price competitive with prices for crude rubber during 1955.

Dr. Semon said that our government's present stockpile of natural rubber, developed to protect against a shortage of *Hevea* rubber in an emergency, is a costly and cumbersome device. The fact that Ameripol SN has been manufactured and tested make the need of a stockpile of *Hevea* rubber for defense purposes much less urgent than before, he said.

New Aniline Process

American Cyanamid Co., Willow Island, W. Va., has begun production at its new multi-million dollar catalytic aniline plant, making use of an entirely new manufacturing process, according to W. H. Bowman, general manager, organic chemicals division.

Aniline has important uses in the manufacture of dyes, rubber chemicals, etc., as well as other intermediates such as diphenylamine.

The newly constructed facility, Dr. Bowman said, uses a fluid bed reactor and new catalyst for the first time in manufacturing aniline from nitrobenzene by this reduction process.

The new facility is located at Willow Island in order to provide better service to the company's customers in the Midwest.

Ameripol SN Rubber in Successful Tire Tests

More results of successful testing of the new synthetic natural rubber said to equal or surpass natural rubber for use in tires of all types has been announced by The B. F. Goodrich Co., Akron, O. The new material answers the nation's urgent need of a replacement for natural rubber, according to W. L. Semon, director of polymer research for the company, speaking before a recent meeting of the Society of Automotive Engineers in Detroit, Mich.

Test data were revealed on Ameripol SN—a synthetic rubber with the same

molecular structure as *Hevea* rubber—which showed that the new material can be used interchangeably with natural rubber for making high-speed truck, bus, airplane, military, and off-the-road tires. In the past, heavy-duty truck tires required natural rubber for most satisfactory performance, owing to the damaging effects of heat build-up in previous synthetic rubbers.

Ameripol SN was developed for Goodrich-Gulf Chemicals, Inc., and announced in 1954. Since then, four types of the material have been produced at the company's pilot plant in

Small Tires Available

B. F. Goodrich Tire Co., Akron, O., has announced that tires and tubes to fit small foreign cars sold in the United States are now available through Goodrich dealers and stores. It was reported that three of the 13 sizes being sold are manufactured in the company's plants in the U.S.A. The remaining 10 are manufactured by Goodrich associate plants in France, Germany, the Netherlands, and Sweden, which also produce original-equipment tires for cars made in their countries and imported to the U.S.

BFG retailers are selling five sizes of four-ply tube-type tires: 5.60-14, 5.00-15, 5.50-15, 5.60-15, and 5.00-16. They also have a sixth tube-type tire, the two-ply 135-380.

Available tubeless sizes are: 5.20-13, 5.60-13, 5.90-13, 6.40-13, 6.70-13, and 5.90-15, (all four-ply), and the two-ply 135-380.

The company said that tires from the Vredestein company in the Netherlands and the Trelborgs company in Sweden will be branded B. F. Goodrich, and those from the Veith company in Germany will be labeled Veith-B. F. Goodrich or just Veith. French imports from the Kleber-Colombes Company in France will be branded Kleber-Colombes.

Griffith Appointments

Larry Bigler has been appointed vice president in charge of sales of Griffith Rubber Mills, Portland, Ore. He will be in charge of sales for the firm's Portland facilities, its subsidiaries in Seattle, Wash., and its affiliate in British Columbia, Canada. Former sales manager of Griffith Rubber Mills, he assisted in developing the Griffith marine line of rubber accessories which are now distributed internationally through sporting goods stores and marine equipment dealers.

Ted Van Ryke and Morris R. Helser have been appointed sales engineers for the firm's protective coatings and linings division in Portland, which has recently been enlarged to serve requirements of Western industry. Van Ryke was formerly employed by chemical construction company. He has had considerable experience in the protective coatings field and received training at Goodrich rubber linings and coatings department in Tuscaloosa, Ala. Helser will specialize in sales of mechanical rubber goods and extrusions in the Portland area.

General offices and rubber fabricating facilities of Griffith Rubber Mills are located at 2439 N. W. 22nd Ave., Portland. Here the firm has supplied rubber roll coverings and other rubber fabrications for the pulp and paper industry since 1911. It also supplies



Hodge Photos

Larry Bigler

molded and extruded rubber goods and protective linings and coatings for industry and manufactures its Griffith marine line of rubber accessories.

The Seattle subsidiary, Chemical-Proof Corp., supplies protective linings and coatings to industries in that area; and Griffith Plastics in Seattle manufactures a variety of industrial plastics products. The firm's Canadian Affiliate is Western Plastics & Coatings, Ltd., New Westminster, B.C.

Liquid Brake System

A new liquid-cooled brake system for aircraft that prevents temperature build-up on braking surfaces by as much as 1500 degrees has been announced by the B. F. Goodrich Aviation Products, Akron, O. The first model to be tested on an airplane was developed for the Air Force under sponsorship of the Air Research & Development Command.

This was reported to be the first practical braking system for aircraft to use fluid for reducing excessive heat in the braking area. The revolutionary disk-type brake, developed and engineered for aircraft at the Goodrich wheel and brake plant at Troy, O., removes heat from the critical wheel and brake area and carries it to a point where it can be dissipated at low temperatures.

Tests conducted by ARDC's Wright Air Development Center showed that the brake performed consistently without fade in consecutive stops, operating at maximum temperatures below 500° F. Brake performance was tested at landing speeds ranging from 60 to 160 miles per hour. At full static engine run-up, before and following the tests, the new brake reportedly held the aircraft at zero velocity.

U. S. Rubber in Texas

United States Rubber Co.'s H. E. Humphrey, Jr., chairman of the board, stated that Texas will continue to lead the nation in the production of synthetic rubber for many years to come, while he was at the formal opening of the company's new Dallas distributing branch on March 4.

Texas plant capacity of 788,000 tons per year is nearly one and a half times greater than the total amount of natural, tree-grown rubber consumed annually in the United States. The state turns out 53% of the nation's general-purpose synthetic rubber used in tires and other products and 77% of the country's butadiene, main ingredient of this rubber.

The Dallas branch will serve as a distribution center for U.S. Royal tires, Fisk and Gillette tires, Koylon foam products, rug underlay, raincoats, and industrial clothing, Naugahyde upholstery, golf balls, U. S. conveyor belts and V-belts, hose, packing, industrial oil-field specialties, and other products.

The area served by the branch includes, for certain products, all of Texas, Oklahoma, Arkansas, Louisiana, Mississippi, New Mexico, and parts of Tennessee.

The new building is a single-story, steel-framed masonry structure with 102,889 square feet of office and warehouse space. Its air conditioned and fluorescent lighted office area contains lunch, meeting, and display rooms. The warehouse is completely palletized.

New Catalin Chemicals

Fourteen chemical intermediates and specialties have been made available by Catalin Corp. of America, New York, N. Y. Catalin, long recognized as a leader in the fields of plastic materials, industrial resins, oil additives, antioxidants, and alkylation products, enters the chemical intermediates and specialties field as a result of a highly intensified program of research and development conducted at the company's expanded laboratories at Fords, N. J.

In addition to this program, a recent cross-licensing agreement between Catalin and Société Française D'Organo-Synthese calls for an exchange of know-how, technical information, and formulae for chemical intermediates.

The new chemical intermediates and specialties of interest to the rubber and plastics industries are: dinitrile azoisobutyric, used as a PVC blowing agent; Catalin UV1, a cinnamic aldehyde derivative used as an ultra-violet absorber for methacrylate; and heptaldehyde, used as an accelerator for rubber and vinyl.

Inquiries from manufacturers using these chemicals in research and production processes should be directed to the company's chemical division.

New Plastics Department

The formation of a divisional development department in Monsanto Chemical Co.'s plastics division at Springfield, Mass., has been announced by the company. Harry M. Walker, manager of research development at the division's Texas City, Tex., location, was appointed assistant director, and David S. Plumb of Wilbraham, Mass., was named director.

It was said that the new staff department was formed to assist the various functions of the division, as well as general management, in the development of immediate and long-range growth plans for new products and markets. The department also will be responsible for liaison with other research and development groups within the company.

At the same time it was announced that the following persons were appointed to positions in the new plastics division development department.

R. W. Crawford will continue also to serve as consultant to general management on management techniques and economic forecasting; and Miss Arek Omartion will continue her business research activities. W. T. Dickens becomes assistant to the director of plastics products sales; while S. P. Lio, assistant sales manager in the Lustrex sales department, will join the new department about April 1. G. R. Lido, technical representative in the company's Washington, D. C., office for the past two years, will be transferred to Springfield as soon as possible.

Reclaimers Election

The Rubber Reclaimers Association, Inc., has announced the election of new officers at its annual meeting held recently at the Warwick Hotel, New York, N. Y.

The new president is Thomas H. Fitzgerald, reclaim sales manager, Naugatuck Chemical division, United States Rubber Co., Naugatuck, Conn. Vice president of the Association is John E. Brothers, chief chemist, Ohio Rubber Co., Willoughby, O. Charles T. Jansen, advertising sales manager of *Rubber Age*, New York, was reelected secretary-treasurer. Chairman of the Association's 1958 executive committee will be Henry L. Dixon, general manager-adhesives, B. F. Goodrich Industrial Products Co., Akron, O.

The Association's educational committee will be headed by Chester L. Peterson, retiring president of the Association and currently president of U. S. Rubber Reclaiming Co., Buffalo, N. Y. This committee works closely with local rubber groups to provide speakers for meetings and lecturers for the various courses in rubber technology now being offered by groups around the country.

Emery Buys Vopcolene

Emery Industries, Inc., Cincinnati, O., has acquired the Vopcolene division of the Vegetable Oil Products Co. for an undisclosed sum. According to Emery, the transaction becomes effective April 1 and will include the entire property, production facilities, trade marks, etc., of the Vopcolene division in Los Angeles, Calif. No changes in personnel are contemplated, and the operation, which will become the Vopcolene division of Emery Industries, Inc., will remain under the direction of Carl Williams, present general manager.

Currently the Vopcolene division is the only manufacturing plant on the West Coast producing a diversified line of fatty acids. Emery plans substantial expenditures for expansion and improvement of production facilities.

This acquisition is the third major expansion by Emery in the last two years; the other two were acquisitions of the fatty acid manufacturing facilities of S. F. Lawrason & Co., Ltd., London, Ont., Canada, and the multi-million dollar joint venture with Monsanto Chemical Co. involving the construction of a new plant at Nitro, W. Va., to fractionate tall oil into rosin and fatty acids.

Emery's products include vinyl plasticizers, special low-molecular weight acids, fatty esters, synthetic lubricant bases, textile chemicals, dibasic acids, fractionated tall acids, stearic and oleic acids, hydrogenated fatty acids and glycerides, distilled animal and vegetable acids, coconut acid and methyl ester fractions, castor derivatives, fish fatty acids and glycerine.

Sun Patent Upheld

The United States District Court, Cleveland, O., has ruled in favor of The Sun Rubber Co., Barberton, O., against two Akron-area firms which the court found had infringed valid patent rights owned by Sun on machinery and manufacturing methods. Defendants in the suit filed by Sun Rubber were National Latex Products Co., Ashland, O., and Akron Presform Mold Co., Cuyahoga Falls, O.

The patents are known as the Molitor Patent 2,629,134 and the Martin and Rekettye Patent 2,629,131. The first covers the method of making hollow articles such as dolls, play balls, and toys from vinyl resins by a rotational casting method which Sun originated; and the second patent covers the machinery which performs the patented process.

According to Sun Rubber officials, the decision is of far-reaching importance in many industries where the processes have been used or could be used, and particularly in the doll, ball, and toy industry.

Diamond Ups Research

Diamond Alkali Co., Cleveland, O., is expanding the market research activities of its commercial development department to provide increased market research on existing products, particularly for Diamond's seven operating divisions and its sales department. The market research section of the commercial development department, previously concerned with new products, is being enlarged to handle this new assignment.

Kemble S. Lewis, sales manager of the plastics division, has been named to head the newly formed sales market research group. Also, Harry H. Redlich, technical service representative at Painesville for Diamond's chromium chemicals division, has joined the commercial development department as division market analyst. Robert R. Fuldauer has transferred to the organization as market analyst from the accounting department, where he has been engaged in trade analysis work. Roy L. Glauz, Jr., and Ralph E. Swackhamer, presently market analysts in commercial development, will continue in their present posts, with their responsibilities broadened to include assignments of direct interest to Diamond's operating divisions to a greater extent than previously. John V. Lawler, active since 1953 in sales and market analysis for Du Pont, has joined the department as a market analyst.

New Vickers Division

The Vickers Petroleum Co., Inc., has formed the Vickers chemicals division which will operate in conjunction with the \$2,500,000 Udex extraction unit now in final phases of construction at the firm's Potwin, Kan., refinery. The BTX petrochemical plant is said to be the first to be constructed by an oil company in Kansas.

Vickers chemicals division will be solely responsible for the sale and the distribution of benzene, toluene, xylene, and other aromatic solvents. Additional products are under consideration and will be announced when these products are determined ready for marketing some time after April 1.

William K. Jackson has been named vice president of research and development and technical assistant to the president; and Arthur B. Mullaly has been appointed vice president in charge of marketing and market development. Dewey Mark has been made general sales manager of the Vickers chemicals division; while Richard J. Boushka has been appointed sales coordinator for the division.

The Vickers chemicals division will headquarter at the home offices of The Vickers Petroleum Co., Inc., Wichita, Kan.

Seiberling Investing

Seiberling Rubber Co., Akron, O., is pouring almost \$1½ million into its production equipment under a two-year plant improvement program now at its midway point. New factory equipment costing \$850,000 was installed in 1957 at the company's headquarters in nearby Barberton, O., and another \$620,000 will be spent this year.

Biggest expenditure has been and will be for new tire building and tire curing equipment. By the end of 1958 more than \$700,000 will have been spent for automatic machines and presses for these operations.

This includes the expense of new equipment for the building and the curing of earthmover tires in 18.00-33 sizes. These tires, for giant highway construction vehicles, are being produced at Seiberling's Barberton plant for the first time with 33-inch rim diameters.

Other improvements include: modernizing equipment in the milling division; developing and installing new finishing machines for white sidewall tires; adding new equipment for the special treatment of nylon cords under high-temperature and tension conditions; and installing an additional beta-ray gage system in the calendaring division. The beta-ray gage is a radioactive device which Seiberling helped develop to measure the amount of rubber and fabric in tire plies—now used industry-wide.

It was reported that this investment program would enable the factory to meet the requirements of a sales force expecting a good market in replacement tire sales for this and future years.

Improved Sealing Tape

Pittsburgh Plate Glass Co. research laboratories, Pittsburgh, Pa., have developed a sealing tape for glass-to-metal, glass-to-glass, and metal-to-metal bonds to meet the specified needs of architects for modern curtain-wall building construction. To be known as #1072 Butene Sealing Tape, the black, rubbery tape is easily applied from a roll just as it comes from the package. This vulcanized, tight-sticking material is said to maintain its elastic and resilient nature while providing long-life weathertight seals of extreme durability. The new sealing tape has shown good performance records under continuous exposure to temperature extremes ranging from -45 to 250° F. In addition to its building applications the product is believed to offer special advantages as a glass-metal, glass-glass, and metal-metal sealer for the aircraft, appliance, automotive, and marine industries. Application and technical data are available upon request to the Suydam division, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

Sidewall-Inflated Tire

The Goodyear Tire & Rubber Co., Akron, O., has developed a new sidewall-inflated tubeless airplane tire which is being tested on the Chance Vought F8U-1 Crusader jet plane. The tire is filled with air by inserting an inflation needle through a rubber sidewall valve.

When the present testing of take-offs and landings with the F8U-1 are completed, similar field tests with other high-speed military aircraft will be conducted. Thus far, tires ranging in size from 20x4.4 up to 17.00-20 have been tested at inflation pressures up to 385 psi.

From the overall wheel, brake, and tire assembly design standpoints, elimination of the standard rim valve by use of the sidewall valve offers a number of advantages. These include: elimination of the wheel-weakening valve hole; greater flexibility in brake design; mounting of dual tires on single wheels without sacrificing the safety of individual inflation; stockage of spare valve parts; elimination of loose and leaking valve stems, plus damage to exposed rim valves; valves more easily replaced in the field; and less weight in valve weight.



Sabena Belgian World Airlines

Harry W. Kenney, with Dayton Rubber Co., Dayton, O., for 30 years, en route to Hadera, Israel, has been loaned by the company as technical adviser to organize a new rubber processing division for Alliance Tire & Rubber Co., Madera, Israel, one of the most modern rubber plants outside the United States. Alliance products are sold widely in Europe and Asia.

Polymer Corp. Plans

The 1958 capital budget of Polymer Corp., Ltd., Sarnia, Ont., Canada, announced by President E. R. Rowzee, reflects a confident future outlook based on sound realistic planning in the face of increasingly stiff competition by other producers of synthetic rubbers. Contributing to this competitive situation are the new plants now under construction in Europe and the recently completed facilities in the United States. In the face of these developments, Polymer continues to market its entire production and confidently anticipates marketing an increased output over the immediate years ahead.

The 1958 budget provides \$7 million to complete projects already committed for and under way which are intended primarily to increase production and to improve product quality, plant efficiency, and employee services and safety. These projects include completion of the research laboratory addition, a new latex plant, the expansion of the butadiene facilities to accommodate the additional feed stocks which will become available in Sarnia during 1958, and improvements to the effluent waste disposal systems. Completion of an additional rubber finishing line is also provided for. The balance will be used to extend utilities and associated services where expanding operations have outgrown existing facilities.

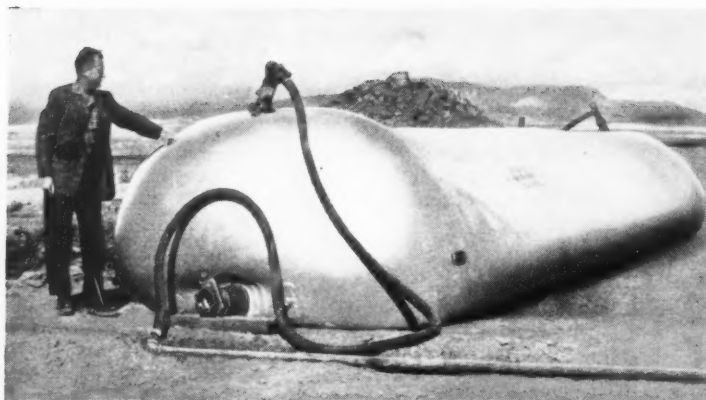
A sum of \$3 million is projected to cover the initial expenditures for a number of new projects. Funds are provided for a start on Polymer's new butadiene plant in Western Canada and for installations designed to raise the general product level of this new plant.

Name Mason President

W. Horace Mason has been elected president and general manager of Seiberling Rubber Co. of Canada, Ltd., Toronto, Ont. Mason, formerly vice president and treasurer of the company, will fill the position vacated April 1 by the retirement of Marcus L. Brown, president and general manager since 1945.

Brown will continue as a director, and H. P. Schrank, executive vice president of Seiberling Rubber Co., Akron, O., the parent company, will be added to the board, as result of a recent meeting. Other directors were reelected.

Besides Mason, officers elected at the organizational meeting following the annual meeting were A. P. Acheson, vice president in charge of sales; A. L. McMullen, vice president in charge of production; C. E. Jones, vice president; and D. N. Morris, secretary and controller. Mason will continue to serve as treasurer.



Firestone collapsible tank for oil-field use



Crane path on Iroquois Dam showing nylon reinforced neoprene curtain

Collapsible Fabric Tanks by Firestone

Lightweight rubberized fabric tanks of 15,000-gallon capacity that are completely collapsible are being adopted in the oil fields of the Southwest to save costs and improve efficiency of operations. The tanks, called "whales" in the oil fields because of their size and shape, are manufactured by The Firestone Tire & Rubber Co. at its Magnolia, Ark., plant. They can be rolled up into a package eight feet long by 2½ feet in diameter and weigh only about one-tenth as much as a steel tank with a comparable capacity.

Because of these features, the tanks can be transported easily from one drilling site to another. Equipped with a simple hoist, a small truck can easily be loaded with seven of the empty Fabritanks, representing a total capacity of 105,000 gallons. In contrast to this, a

large semi-trailer is needed to carry one 15,000-gallon steel tank.

Exploration Drilling Co., Tulsa, Okla., has had excellent results with the "whale" tank in operation in the Southwest. The Firestone tanks have been in use in other operations in this oil-producing area for more than a year.

When filled to capacity the tanks are 47 feet long, 11 feet wide, and five feet high. They are constructed of two plies of nylon fabric coated with a special neoprene compound designed to protect the tanks against abrasion and the harmful effects of changeable atmospheric conditions. The tanks are D-shaped in cross-section, when full, and are equipped with an internal system of flexible stabilizers which prevent rolling on hilly terrain.

Neoprene Protection for Power Source

The electrical power source, used to operate two 350-ton traveling cranes on the Iroquois Dam of the St. Lawrence Power Project, is being protected from the weather by a curtain of neoprene synthetic rubber, a product of E. I. du Pont de Nemours Co., Inc., Wilmington, Del. Similar curtains will be installed this spring on the two other dams located in the International Rapids Section of the Seaway. The neoprene weather shields will be permanent, year-round fixtures.

These gantry cranes, used primarily to lift the 32 sluice gates that control the backwater level, receive electrical power from a bus bar carrying 550 volts. The bar, which runs the length of the dam, is enclosed in a metal housing. One side of the housing, where the crane's arm reaches in to contact the bar, is protected by a thick curtain which is made of nylon reinforced neoprene.

The curtain consists of two inter-

locking strips, 1,970 feet long, weighing a total of 10,000 pounds. The joint is of tongue and groove design. The contact arm lifts the upper strip out of the groove as the crane moves along the top of the dam. The flexible curtain snaps closed automatically as the arm passes.

Iroquois Dam, completed last fall, will maintain Lake Ontario at its natural level. Other curtains will be installed this spring on the Long Sault Dam and on the St. Lawrence Powerdam.

The Irving B. Moore Corp., Boston, Mass., is contractor for the curtain installation.

New Nepcozone Butyl

National Electric Products Corp., Pittsburgh, Pa., according to R. Lyle, chief chemist, has developed a superior

Nepcozone butyl rubber compound for insulating cables, as well as a special extruding process, called Nepcoprocess, for extruding the Nepcozone butyl rubber insulated cables. The key to the problem was finding a suitable vulcanizing agent for the Nepcozone butyl and designing a special extruder for the compound.

In a laboratory investigation a vulcanizing agent was found which would impart the qualities required for the selected Nepcozone butyl compound. These qualities included long life at service temperatures (165 to 195° F.), high heat resistance, imperviousness to water, and electrical stability in water for long periods of time at service temperatures.

It was necessary then to design a special extruder in which the butyl rubber was slowly and uniformly worked to the optimum consistency for extruding under controlled conditions, and the possibilities of underworking or overheating were eliminated. A continuous vulcanizing method was selected from the various ones in use. This Nepcoprocess resulted in giving the cables three important qualities: it assures concentricity of the conductor and insulation with a uniform wall thickness; unused vulcanizing agents are expelled as volatile decomposition byproducts, thus giving the Nepcozone insulation good heat life and electrical stability; and void-free structure is assured.

In the Nepcoprocess at the high temperatures employed, gaseous products are soluble in the butyl rubber and so do not form blisters or create porosity. As the extruded cables cool, these gases are expelled and diffuse out of the rubber without forming bubbles because a pressure is maintained under close control. The final result was a combination of high electrical insulating quality, flexibility, and stability. The insulation was designed specifically for high-voltage applications, but has been used for low-voltage applications also.

Footwear Plant Closing

United States Rubber Co., New York, N. Y., will shut down its footwear plant at Milan, Tenn. Final closing date is scheduled for July, with stepwise reduction of employees in the interim.

Production of rubber-soled shoes will be transferred to the company's larger and longer established plant in Mishawaka, Ind., where floor space has been made available by reduced government requirements for self-sealing airplane fuel cells and by rearrangement of foam rubber processing operations.

It was found by the company that the economies involved in consolidating the Milan production at Mishawaka are necessary to meet the increasing competition from low-priced rubber and canvas footwear manufactured here and abroad. Increasing transportation rates have raised the cost of shipping raw materials to Milan and finished goods to central warehouse and distribution points, it was reported.

A company spokesman expressed regrets for the employees and friends in Milan and announced that employees will be notified of their individual termination dates as far in advance as possible.

The Milan plant was opened by the company in 1947. The 275 people now at the plant will be released by groups. It is planned that the first group will be released early in April, and dismissals will continue until around July.

Employees with at least five years of credited service with the company will be covered by the company's termination allowance plan. It is estimated that the total amount of such allowance to be paid to Milan employees will be about \$250,000.

Scrap Group Meets

Representatives of member firms of the National Association of Waste Material Dealers, Inc., met March 15-18 at the Waldorf-Astoria, New York, N. Y., for the forty-fifth annual convention of the Association. The Scrap Rubber & Plastics Institute of the NAWMD heard an address by R. H. Sharp, U. S. Rubber Reclaiming Co., Buffalo, N. Y., on "Rubber Reclaiming, Its Future and Waste Material Dealers," and a group discussion, chairmanned by S. Freedman, H. Muehlstein & Co., Inc., New York, president of the Institute.

Mr. Sharp, purchasing agent for his company, reported that approximately 270,000 tons of reclaimed rubber were consumed last year in the United States. This reflected a decline in ratio of reclaim to all rubber consumed from 16% in 1956 to 15.5% in 1957. He expressed some optimism for reclaim in 1958, expecting an upswing in the near future due to increased demands for passenger

tires and, in part, to the suspension of the proposed increase in carload freight rates.

He also mentioned a recent development of his company called "Saf-Pla," a rubberized surfacing material for playgrounds and similar applications, which will help widen the scope of the reclaiming business. Such developments and new uses for reclaim, as well as a tone of confidence, will help bring about the upturn, he reported.

L. N. Larsen, Muehlstein, chairman of NAWMD's traffic committee, spoke briefly on the suspension of the 3% proposed increase of freight rates. The rail carriers' proposal is presently being investigated, but it is expected that scrap dealers will get a reduction of rates. The exact amount is thus far undetermined.

Mr. Freedman said the outlook for the near future tends to be slightly optimistic. He reported this attitude is due to the seasonal upturn of consumer purchases of replacement tires during the summer months which would reflect itself in terms of increased consumption of reclaimed rubber. He mentioned that inventories are at relatively low levels and buying is being done on a month-to-month consumption basis.

Officers of the Institute will continue in their capacities for the coming year. They include: president, Mr. Freedman; vice president, Wm. C. Zekan, A. Schulman, Inc.; and secretary-treasurer, M. Mighdoll, also of Muehlstein.

U. S. Rubber Expands Far West Distribution

H. E. Humphreys, Jr., chairman of the board, United States Rubber Co., New York, N. Y., who attended an open house for civic and industrial leaders on February 25 at the company's new Seattle, Wash., distribution facilities, predicted long-range business gains for the Pacific Northwest. U. S. Rubber anticipates increasing demand from the region's expanding population for the company's rubber, plastics, chemical, and textile products.

Located at 5900 First Ave. South, the new building is typical of the 25 new distribution branches constructed by the company since World War II. It is of steel frame construction with tilt-up precast concrete wall panels for the 52,000-square-foot warehouse area and face brick for the exterior of the 11,200-square-foot office area.

The warehouse is completely palletized. It is served by a four-car siding of the Union Pacific Railroad, with off-street truck loading docks to accommodate eight trucks. The office area, fully air conditioned, contains lunch, conference, and display rooms. Customer and employee parking space is provided, and the property allows ample room for expansion of the building.

Buys Davis & Bennett

Davis & Bennett, Inc., Worcester, Mass., a 35-year-old organization of consulting chemists, chemical engineers, and biologists, was recently acquired by Foster D. Snell, Inc., New York, N. Y., an organization of consulting chemists and chemical engineers. This acquisition represents the fifth major expansion for Snell within recent years.

Benjamin Seibel, of the Snell organization, has been named laboratory director of the Davis & Bennett division. He will reside in Worcester and officially assumed his new post in March. In addition to his experience in polymers and textiles, he has for nine years worked extensively on many problems in chemistry and physics with the Snell organization and has been responsible for research and development and evaluation of paper and fibrous materials, as well as work in the field of light microscopy and its various applications.

Industrial Designing

Application of the principles of good design to industrial equipment and components was concretely discussed by designer Paul Wrablica, head of Paul Wrablica Associates, at a slide-illustrated lecture at his new headquarters, 120 E. 56th St., New York, N. Y., on February 28.

Until now, most industrial design has actually been applied to consumer products and packages. But, it was reported, now that industrial equipment and electronic components are increasingly sold as well as simply specified and bought, manufacturers are looking for ways to cut production costs, while increasing a product's intrinsic value and merchandising appeal.

The basic requirements for such industrial product design usually include: preservation of the general size and shape of components, since they must fit into previously specified assemblies; for products already in production, use of the same tools and dies as much as possible; and acknowledgment in design of human psychology in the handling and the evaluation of products.

Case histories detailing the operation of these and other principles were outlined by Mr. Wrablica with "before" and "after" color slides. The firm, which is marking its fifth year in business, invites visitors to an exhibit at its headquarters to learn something of what can be done with industrial equipment and components within the limits of production and assembly specifications. Small electrical and electronic components and products of a variety of materials will be exhibited to be handled. Larger products, architectural and interior design, and designs for packages and other graphic arts are shown in photographs on separate walls.

Courtaulds Reorganizes

A reorganization of the sales development and technical service departments of Courtaulds (Canada), Ltd., Cornwall, Ont., into a unified marketing division under a general marketing manager has been announced. The new general marketing manager is J. A. Dixon, formerly general sales manager.

The reorganization has been made in recognition of the necessity of having under one control all aspects of marketing the company's products: viscose staple fiber, high-tenacity yarns, and textile filament yarns. This includes technical customer service, sales development, advertising and merchandising, as well as direct sales.

The marketing of the company's products will be divided into two main groups: apparel and domestics as one and industrial as the other. T. R. Dalglish, Montreal, with eight years' experience in sales and production with the company, has been appointed marketing manager in the apparel and domestics group. J. J. Harrison, Toronto, will continue in his capacity as industrial marketing manager, working with a sales development and direct sales group consisting of W. I. Gladwish, Montreal. P. N. Haller, Montreal, and E. C. Mercier, Cornwall.

Firestone Plans Decentralization

The Firestone Tire & Rubber Co., Akron, O., has announced that, effective March 1, the Firestone Industrial Products Co. will be decentralized into two separate companies to cover more adequately the expanded activities and increasing diversification in products, and better to serve Firestone customers.

Firestone Rubber & Latex Products Co., Fall River, Mass., will take over the production, marketing, and servicing of Firestone Foamex, the material used in mattresses, upholstery, automotive cushioning, footwear, and many other applications. This company will also produce and distribute numerous other rubber and plastic items such as automotive gaskets, extruded and molded rubber products, food container gaskets, crash pads and other polyurethane items, plastic and rubber caster wheels, and Contro rubber thread used in the garment and textile industry.

The unit at Noblesville, Ind., will continue to be known as the Firestone Industrial Products Co. and will produce, market, and service a complete line of molded rubber products, including semi-pneumatic tires and the newly developed Airide, an air spring currently being used on many of the new-model automobiles.

These companies will continue to be directed by P. P. Crisp, who joined Firestone in 1929 and was appointed

president of the industrial products division in 1942. R. D. Smith will be president, and R. J. Mitchell will be vice president in charge of sales of Firestone Industrial Products Co., Noblesville. C. J. McCready will be president, and W. W. Llewellyn will be vice president in charge of sales of the Firestone Rubber Latex Products Co., Fall River.

Bachner Award

Outstanding contributions to the practical applications of plastics will be honored this year with the inauguration of the Bachner Award sponsored by the Chicago Molded Products Corp. as a testimonial to the work of the five Bachner brothers who founded the company 39 years ago and to the many others who have contributed to the growth of the plastics industry.

According to John Bachner, president of the company, the object of the award is to stimulate and encourage the imaginative employment of plastics materials in the initiation and improvement of products and the production of these products. The award will consist of a plaque by the well-known industrial designer, Jean Reinecke, and \$1,000. The Bachner Award plaque, executed entirely in plastics materials, will be presented to the winning company, the prize money to the person or persons in the company whom the winning manufacturer designates as most responsible for the achievement. Additional honorable mention citations will be made.

The award competition will be open to all manufacturers of products which employ plastic components or are totally plastic and are molded, extruded, or vacuum or pressure formed. Fibers, flexible films, filaments, resins, and coatings are not eligible. The award is to be presented every 2½ years concurrent with the SPI national exposition and conference.

The newly established award will be administered by a special committee made up of leading figures in industry. A panel of judges, to be chosen by the Bachner Award Committee, will select the winning applications. Information and entry applications may be obtained through William T. Cruse, The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.

Biggs Is Acquired

The Biggs Boiler Works Co., Akron, O., has been acquired as a wholly owned subsidiary by the Union Spring & Mfg. Co., New Kensington, Pa., according to W. F. McCabe, president of Union Spring. Biggs, established in 1887, is a steel fabricator, manufacturing all types of pressure vessels as well

as special fabricated steel and alloy plate work for the rubber, paper, chemical, and process industries.

It was announced that the purchase was a part of Union's diversification program and will mean the joining together of Union's steel foundry and the Biggs steel fabricating facilities. T. F. Krizanek, Biggs vice president of sales for the past four years, will remain in that position under the new management.

The new subsidiary will be operated under the name of The Biggs Steel Foundry & Fabricating Co., with the present management.

DTBP-Zeolite Curing For Vinyl Silicones

The silicones division, Union Carbide Corp., New York, N. Y., has announced that it is using so-called molecular sieves as a carrier for a volatile, liquid catalyst, X-1960, used for curing vinyl silicone rubber. X-1960, a white paste containing di-tertiary-butyl-peroxide (DTBP), is a highly volatile catalyst which heretofore had presented handling difficulties.¹

The story of how DTBP is locked in so that it would not evaporate and could be conveniently used dates back to 1954 when the company announced the availability of vinyl-containing silicone gum stocks; the first one was Union Carbide W-96 Gum. Recently, with the cooperation of Linde Co., division of Union Carbide Corp., the silicones division development laboratory at Tonawanda, N. Y., perfected a method for adsorbing the liquid DTBP on to a Linde so-called molecular sieve.

Molecular sieves are tiny new types of synthetic crystalline zeolites which have outstanding adsorbent qualities. These sieves made an ideal carrier, for their alumino-silicate composition, with a particle size of one to two microns, allowed incorporation in silicone rubber compounds with no detrimental effects.

Molecular sieves also have the ability to retain the adsorbed material with small losses at storage temperature. At effective curing temperatures, the catalyst is released almost 100%. These and other qualities made it easy for the fabricators to disperse the X-1960 catalyst into silicone rubber compounds at the mill.

X-1960 has made possible simplified curing of large masses of rubber. Thus, large silicone-covered rolls were made for use in textile, plastics, and paper industries. In the molding of large parts, X-1960 allows a one-step postcure in place of a long scheduled step cure. In molding gaskets, use of X-1960 not only assures the lowest possible compression set, but also minimizes fabrication problems such as scorching.

¹See RUBBER WORLD, June, 1956, p. 460.

Radiation Processing

Eastern and Midwest chemists, physicists, and engineers now have a tool at their disposal—an eight-million-volt linear electron accelerator equivalent in power output to almost one half of the United States annual production of cobalt-60. With it, they can explore new means to use atomic radiation to preserve food, improve plastics and rubbers, produce new chemicals, and sterilize drugs.

The machine, which emits high energy electrons, X-rays and neutrons, can be rented by the hour for both research and commercial radiation processing. It is located in Rockford, Ill., in the Midwest Irradiation Center just opened by W. F. & John Barnes Co. and Applied Radiation Corp.

Although several installations offer radiation sources on a rental basis, for many applications these sources are either too small, have too little penetration, or are too remote for easy access (Applied Radiation has the only other available linac installation near San Francisco, Calif.). Since the field is still new, commercial findings are being kept under wraps, and the literature is barren of interesting research data.

The Center's Mark I-F2 linear electron accelerator, built by Applied Radiation Corp., Walnut Creek, Calif., emits high energy electrons, X-rays, and neutrons as desired. Linear electron accelerators, available commercially for only several years, operate by a different principle than most commercial machines. The Midwest accelerator operates as high as nine million electron volts (Mev) and can irradiate with electrons materials of unit density up to one inch thick; by irradiating from two sides, over two inch sections can be uniformly treated. With a simple tungsten target, the electron beam is converted to X-rays more penetrating than the gamma rays from cobalt-60. On the other hand, if it is desirable to treat only surface areas, electron beam energy can easily be reduced to a low level; so both very thin and very thick objects can be accommodated.

The Midwest accelerator's electron beam is equivalent to 140,000 curies of cobalt-60. It can process up to 1,600 megarad-pounds per hour. Since all the energy is emitted in the forward direction, equipment is easily set up for irradiation, and objects are conveniently conveyed through the ionizing beam.

New Hose Process

A new hose manufacturing process, the first major change in hose building since 1904, has been put into volume production at the Goodyear Tire & Rubber Co.'s North Chicago, Ill., plant. Called the Acala process, the new method produces on an economical basis a long-length hose having dimen-

sional stability. This is considered to be a significant break-through in hose design. Conventional braided hose shortens in length under pressure as much as 18%. This condition requires that longer-than-necessary lengths be installed in service.

The danger of coupling pull-off has been eliminated with Acala hose. This characteristic will save the appliance industry alone thousands of dollars weekly in adjustments. Conventional washing machine inlet hose can pull out of its couplings when installed without slack, releasing open water lines. Because Acala hose does not shorten under pressure, no strain is placed on couplings. Other examples of current end-uses for new Acala hose are in power steering units and truck air-brake systems in the automotive industry.

The new-process hose was confined to specialized applications during the development and field trial stages, but new markets are now being sought by Goodyear for Acala hose. It is expected that greatest use will be in hydraulic and air systems where dimensional hose stability is required for proper functioning of these units.

Acala process hose is produced completely sealed in liquid and undergoes temperature changes from many degrees below zero to several hundred degrees above during the production process. While its temperature range is great during production, the braid angle of Acala hose is constant, thus restricting movement of hose during production and service.

Bridgwater-Athens Merger

Athens Machine Co., a wholly owned subsidiary, merged with Bridgwater Machine Co., Akron, O., effective January 1. The new name of the firm in Athens, O., is now Bridgwater Machine Co., tire mold division.

Simultaneously it was announced that Albert J. Slatter, vice president and general manager, will retire April 1. Before joining the Bridgwater organization, he was a tire engineering consultant in Akron. He indicated that on retirement he will again enter that field. Succeeding Slatter at Athens will be Frank Batdorff, now assistant treasurer and office manager.

The firm will continue manufacturing operations at its present address in Athens, O.; the only effect of the merger is that the tire mold manufacturing firm is now fully integrated with Bridgwater, the parent company. Sales correspondence will continue to be handled through the Akron office at 706 Second National Building.

The operation was established by Bridgwater in 1945 for the sole purpose of manufacturing automobile tire molds. It is said to be the largest plant of its kind in the world.

A-C Super-Seal Motor

Introduction of a line of super-seal motors with silicone-rubber Silco-Flex insulation rated for Class B temperature rise has been announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis. These motors are available at the same price as conventional Class A machines with organic taped and varnish insulation.

Open-type super-seal motors rely on protective qualities inherent in the Silco-Flex system to withstand atmospheric contaminants. Complicated motor enclosures, designed to protect inadequate insulations, have been eliminated in many applications, at substantial cost savings.

Heat aging is eliminated as a consideration in forecasting the life expectancy of these motors, since the insulation is thermally stable far beyond the conservative Class B operating range.

Complete sealing against contaminants is a unique characteristic of the Silco-Flex system. Additional protective measures are unnecessary. For example, moisture protection has been required in most motor applications, since moisture degrades the dielectric strength of most coil insulations.

Motors for rubber mill applications where carbon black contamination is a problem have required elaborate and expensive protective measures for continuing service. Operating experience has proved that sealed and vulcanized Silco-Flex insulation affords no path of entry to foreign particles, and that totally enclosed motor types are no longer required.

Resistant to oils and chemicals found in many industrial applications, Silco-Flex insulated super-seal motors need no extra protection against corrosives or oils.

Field coils of synchronous super-seal motors are equally as well protected as stator coils. Integrated construction, which combines epoxy resins and oriented glass fibers in a fully sealed indestructible field coil, locked to the pole piece, is now a standard feature, with no price increase, according to the company.

Polyseam Adhesive

Anchor Adhesives Corp., Flushing, N. Y., has announced development of Polyseam, an improved extremely flexible polyurethane adhesive, said not to stiffen with age. The adhesive is transparent and does not tend to discolor polyurethane. It leaves no residual odor, requires no mixing, does not contain isocyanate, and for this reason does not present the toxicity problem prevalent in many isocyanate adhesives. Polyseam loses depression tack within 24 hours, forming a permanent, flexible bond. It is also said to make possible the fabricating of convoluted foam which allows only a minimum surface for bonding.

Rubber Section 1957 Safety Contest Winners

The final results of the 1957 Rubber Section Safety contest of the National Safety Council, Chicago, Ill., have been announced. Of the 166 plants competing in the annual contest, reports from 128 were received. The accident frequency rate is based on lost-time accidents per million manhours worked and 33 of the plants had perfect records in the 1957 contest. First-place winners, (many of these were ties), second-place, and third-place winners in some cases, follow:

Division 1 (more than 400,000 man hours worked per month): United States Rubber Co., Mishawaka, Ind., and Firestone Tire & Rubber Co., Pottstown, Pa., tied for first place, with no lost-time accidents; and the U. S. Rubber footwear plant at Naugatuck, Conn., won third place.

Division 2 (200,000 to 400,000 man-hours per month): First-place tie occurred between the U. S. Rubber plant at Providence, R. I., and Dominion Rubber Co., Ltd., St. Jerome, P.Q., Canada (a U. S. Rubber subsidiary). Firestone's Des Moines, Iowa, plant won third place.

Division 3 (100,000 to 200,000 man-hours per month): First place went to Simplex Wire & Cable Co., Cambridge, Mass.; second place, to the Goodyear Tire & Rubber Co. plant in Mexico; and third place to Dryden Rubber Division, Sheller Mfg. Corp., Chicago.

Division 4 (50,000 to 100,000 man-hours per month): The following plants all won first-place awards in this division: Firestone Xylos Rubber plant, Akron, O.; American Synthetic Rubber Co., Louisville, Ky.; U. S. Rubber Gilmer plant, Tacony, Pa.; Hewitt-Robbins, Inc., Restfoam Division, Buffalo, N. Y.; Firestone World Bestos Division, New Castle, Pa.; and Duroflex, Inc., Buena Vista, Va.

Division 5 (under 50,000 manhours per month): Here again a large number of companies won first-place awards, including: Goodyear reclaim plant and RRC plant, Akron; U. S. Rubber, Santa Ana, Calif.; General Shoe Corp., Nashville, Tenn.; B. F. Goodrich Works Laboratory, Akron; Firestone research division, Akron; B. F. Goodrich Co., Riverside, N. J., and Du Bois, Pa.; Canadian Lastex, Ltd., Montreal, P.Q.; Firestone, Magnolia, Ark., and Xylos Rubber division at location not given; Gates Rubber of Canada, Ltd., Brantford, Ont.; Goodyear, Muncie, Ind.; Firestone retread plant, Akron; and Lobl Mfg. Co., Middleboro, Mass.

The average frequency rates for the various divisions were as follows:

Division	Frequency Rate
1	2.02
2	2.37
3	2.40
4	6.34
5	6.09
All	2.64

At the Rubber Section meeting in October, 1957, in Chicago, Ray Hart, Dayton Rubber Co., reporting for the Rubber Section's statistics committee, gave figures for the rubber industry 1950-1956 and stated that in 1956 the rubber industry rated seventh with reference to frequency and twelfth for severity, in competition with 41 major industries. A comparison for 1957 is not available as yet.

In connection with the 1957 first-place tie in Division 1, the employees at the U. S. Rubber plant in Mishawaka, Ind., worked 10,250,040 man-hours without a lost-time accident or disabling injury, according to a statement by the company in December, 1957. The Firestone plant at Pottstown was reported as working 9,017,740 manhours as of January 24, 1958, without a lost-time accident, according to that company.

Officers of the Rubber Section, NSC, for 1957-58, elected in October, are: general chairman, C. E. Beck, St. Clair Rubber Co.; vice chairman, M. R. Batche, Firestone Tire & Rubber Co.; secretary, W. J. Dooling, B. F. Goodrich Footwear & Flooring Co. Division, B. F. Goodrich Co., Watertown, Mass. The publicity chairman is Mr. Hart.

U. S. Rubber's New Tire Testing Device

United States Rubber Co., New York, N. Y., plans to install what is said to be the most powerful tire testing device in the world at its Detroit, Mich., tire development laboratory—a seven-ton wheel that will spin at 300 miles per hour. The device, called a dynamometer, costing more than \$750,000, will be used to test aircraft tires and will be capable of handling testing requirements for the next 15 years. The dynamometer is being built by Adamson United Co., Akron, O.

It was reported that the development of heavier jet fighters and bombers with faster landing and take-off speeds has increased the demands on aircraft tires to the point where present testing equipment is inadequate. The new dynamometer will be able to test and qualify aircraft tires in all known sizes and number of plies at speeds up to 300 miles per hour and under load ratings up to 80,000 pounds.

The steel wheel, to be installed this spring, will be powered by a 1,250-horsepower motor. The wheel, eight feet in diameter, will test aircraft tires in simulated landings, where highest tire temperature occurs toward the end of the run when speeds are low, and in simulated take-offs, where highest tire temperature occurs at maximum speed when tire stresses are highest. With the dynamometer, speed and load

can be controlled to reproduce the desired conditions of either take-off or landing.

The new wheel will take its place as the latest piece of equipment at the company's Detroit laboratory, said to be the largest tire testing center in the world. More than 10 million tire miles are run on test wheels at the laboratory each year.

Monsanto's Purchase

Monsanto Chemicals (Australia), Ltd., has entered into an agreement with Drug Houses of Australia, Melbourne, to purchase all outstanding shares of two of that company's subsidiaries, according to Marshall E. Young, vice president of Monsanto Chemical Co., St. Louis, Mo., and general manager of the company's overseas division.

The two companies being acquired from Drug Houses are Beetle Elliott Pty., Ltd., and D. H. A. (Chemicals) Pty., Ltd. Beetle Elliott manufactures plastics materials, principally phenolic, urea, and melamine molding powders, as well as polyvinyl acetate emulsions. D. H. A. (Chemicals) manufactures sulfuric acid, phenothiazine, some inorganic salts, and various agricultural chemicals.

Both plants operate plants in the Sydney and Melbourne areas. The principal shareowners of Monsanto Chemicals (Australia), Ltd., are Monsanto Chemicals, Ltd., (England) and Monsanto Chemical Co., St. Louis.

Wins \$500 Award

The highest employe award in the history of American Latex Products Corp., Hawthorne, Calif.—\$500.00—was made recently to James Denney for his redesign of a plastic production machinery component. According to Executive Vice President and General Manager T. P. Dougan, the redesign problem had been submitted to consulting engineers, without a satisfactory solution.

Denney, who works for the company as a general maintenance mechanic, asked for the assignment and solved the problem in two days. It involved a complicated mechanical control of the chemical formation of complex molecular chains. Although engineers said the cost would be prohibitive, Denney solved the problem at a very nominal cost to the company.

Dougan said that aside from the obvious financial benefits to the company resulting from the improved product quality and standardization, and the saving of production time, Denney's award has stimulated the submission of employe suggestions of an extremely thoughtful and practical nature.



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Wabash 1-5500
Cleveland 5
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NEWS

BRIEFS

National Polychemicals, Inc., Wilmington, Mass., a producer of specialty organic chemicals for the rubber, plastics, and related industries, employs Dynel bags in its special centrifugal extractors to hold chemicals during a moisture removal or spin-drying process. Woven of Union Carbide Corp.'s acrylic fiber, the Dynel bags provide many times the useful service life as those of other fabrics in common use in centrifugal rotation cycles at speeds of 1,100 r.p.m. On the average, this works out to about five production days, or approximately 200 14-minute whirling cycles for Dynel, as compared with just one or two cycles for bags of other materials, before needing to be repaired, it was reported.

B. F. Goodrich Tire Co. has started construction on a new retread plant at Phoenix, Ariz., which will open in May to serve a four-state area comprising Arizona, New Mexico, Nevada, and Utah. The plans call for a 10,000-square-foot building which will be equipped to handle large off-road tires of the type used at the Glen Canyon Dam project and other construction work in the four-state area.

United States Rubber Co., New York, N. Y., is manufacturing a rubber-steel construction of hose, called U. S. Red Royal Submarine flare hose. It has a special, high-tensile cord carcass for strength and is covered with corrosion-resistant neoprene rubber which covers even the metal connecting joints to protect them from salt water. The rubber-covered hose is draped to the ocean floor and then carries waste gas from off-shore oil wells in the Gulf of Mexico to where it can be safely flared.

Parker-Hannifin Corp.'s Parker Rubber division at Cleveland, O., and Los Angeles, Calif., is custom-molding a tiny cylindrical shape, about the size of the head of a pin, with a hole of 0.010-inch diameter through it—an example of the subminiature synthetic rubber parts being manufactured by the division. This particular part is being used in electronic equipment. Design suggestions as well as quotations based on customer drawings are available from the division.

Enjay Co., Inc., New York, N. Y., a leading marketer of petrochemicals, butyl rubber, etc., has opened a new sales office at 207 Hawthorne Lane, Charlotte, N. C., which will serve Enjay customers in the southeastern industrial region—an area that includes parts of Virginia and Tennessee and all of North Carolina, South Carolina, Georgia, and Florida. J. W. Toney will be in charge of Enjay's Charlotte office, with D. L. Duncan serving as a technical representative.

The Firestone Tire & Rubber Co.'s farm tire sales department has announced that it is lending new tires to local farmers for use under a farm tire-loan program while their worn tires are being retreaded or repaired. The service is free to all tractor owners. Store managers send service trucks to farms where tire changes take place. The tire firm has tractor tire retread shops strategically located throughout the nation's farm regions. The company's original-equipment tread design is used for all rear tire retreads.

The J. O. Ross Engineering Division, Midland-Ross Corp., has completed plans for construction of a new Chicago office building to be located in suburban Mt. Prospect, Ill. The new 12,500-square-foot building, scheduled for completion in September, will house engineering and office personnel servicing the Ross Midwest area and will also include facilities for Chicago personnel of John Waldron Corp., a unit of Ross Engineering, which manufactures web converting machinery and flexible couplings. Ross Engineering designs, fabricates, and installs air process systems used in industrial heating, drying, and curing operations in such fields as the paper, rubber, plastics, automotive, textile, metal finishing, and foundry industries. The new office will be headed by L. G. Janett, vice president and manager, Chicago office, and will service the territory bounded by Canada, the Gulf of Mexico, the Rockies, and the Middle Eastern States.

Fullerton Mfg. Co., Fullerton, Calif., according to Ray Stringfield, factory manager, has installed a new, specially built 635-ton 42- by 42-inch press to handle large oil-field parts.

Borden Chemical Co.'s Resinite department, New York, N. Y., is now offering Resinite Super-Heat 125 vinyl insulation sleeving in four colors besides the original black. The high-temperature vinyl sleeving will now be manufactured in black, white, yellow, blue, and green for use by manufacturers of appliances, electric and electronic components, and wiring harnesses requiring color coding. Resinite Super-Heat 125 is a heavy-duty vinyl insulation, compounded to resist continuous temperatures as high as 125° C. It is reported to have unusual resistance to cut-through and abrasion, as well as to immersion in oil, tar and pitch.

Columbian Carbon Co., New York, N. Y., will build new, large laboratories at Princeton, N. J., in 1958, for operation early in 1959. They will provide facilities for uninterrupted continuity of basic research in, and development of, new applications for the company's present product lines and processes. They will permit the various company laboratories now located at Brooklyn, N. Y., Monroe, La., Trenton, N. J., and Tacony, Pa., to apply themselves more completely to product and process improvement. Finally, they will provide needed room and facilities for research directed toward wholly new products and processes for manufacture.

E. I. du Pont de Nemours & Co.'s R. H. Barton stated that preformed neoprene seals for curtain wall construction will prevent leakage and excessive air infiltration, while he was at a recent meeting of the Aluminum Window Manufacturers Association at Miami, Fla. He reported that non-fatiguing resilience and weather resistance make neoprene a satisfactory substitute for inelastic whitening-oil putty. Design considerations for extruded preformed channels differ little from those for other sealing methods.

The B. F. Goodrich Canada, Ltd., plant in Kitchener, Ont., to provide additional roll covering and tank lining facilities is now in operation. Recently the first finished roll was shipped from a new building housing the most modern roll covering plant in Canada. The shop is equipped to handle rolls up to 35 feet long and 42 inches in diameter. The smallest rolls covered are two inches in diameter and six inches long.

Argus Chemical Corp., Brooklyn, N. Y., manufacturer of vinyl stabilizers and plasticizers, is expanding its plant facilities. The company has acquired 3½ acres of land as the site for a new building. The new plant will provide additional facilities for the production of Drapex plasticizers and Mark stabilizers, extensive areas for the manufacture of fatty ketones and, in addition, house the company's shipping facilities.



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United States Rubber Co., New York, N. Y., has on exhibit a 10-ton automated tire-building machine producing uncured white sidewall tires in a Rockefeller Center show window. The big machine is more than 10 feet tall and is being operated on a production basis at the exhibit hall to demonstrate how U. S. Royal tires are built. The exhibit hall, located at 60 W. 49th St., is open to the public. Other highlights of the exhibit include reinforced plastic paneling for architectural use; a model of an earth satellite; a collapsible rubber shipping container, 32 feet long, that holds more than 2,000 gallons; a sleek, reinforced plastic outboard cabin cruiser; and a cut-away auto chassis showing new rubber and plastic automotive products.

Wm. T. Hand Equipment Co., Manhasset, L. I., N. Y., has been formed by William T. Hand, previously vice president of Consolidated Products Co., Inc., for 30 years. Presently this newly formed company is selling the surplus used machinery from the modern Long Horn Tin Smelter at Texas City, Tex., and from several other plants. Engaged as dealer in used machinery for the chemical, processing, and related industries, the scope of operations for the firm includes purchase and sale of complete plants or single machines refinancing and appraisals.

Parker-Hannifin Corp., Cleveland, O., has announced that its two divisions which have specialized in the manufacture and sale of a wide range of rubber and metal seals for fluid systems will be united in a single major organization to provide greater technical and sales attention for this rapidly growing part of the company's business. The name of the new division, which will combine present operations of Parker Rubber division and the Franklin C. Wolfe division, will be Parker Seal Co., division of Parker-Hannifin Corp. Administrative headquarters of the new division will be in Culver City, Calif., under the direction of Paul F. Smith as general manager.

The Goodyear Tire & Rubber Co., Akron, O., has announced that production of tires for the rapidly expanding foreign car market in this country is on a decided upswing. Approximately 93% of the autos now being imported to the United States can be fitted from a selection of 10 sizes of tubeless Custom Super Cushion tires currently in production. These sizes are: 5.20-13, 5.60-13, 5.90-13, 6.40-13, 5.00/5.20-14, 5.60-15, 5.90-15, and 6.00-15. Sizes 6.00-15 and 5.90-15 fit American-made as well as imported vehicles. Tires in sizes 5.50-15 and 5.25-16 are available in tube-type construction only.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has extended its line of dielectric heaters to include units up to 200 kw. The company's electronic heaters, available in a 3-200 kw. range, are speeding production and cutting costs in a wide range of jobs calling for heating, drying, baking, and curing of non-conductive materials. Applications include the drying of synthetic fibers, twist setting of rayon cord, jelling and vulcanizing of rubber, and heating of plastic preforms.

Pennsylvania Industrial Chemical Corp. has placed on stream a new plant for production of hydrocarbon resins and aromatic solvents at West Elizabeth, Pa. The new facilities will supplement the company's other plants in the manufacture of Picco products for paint, rubber, and general chemical compounding industries. The highly automated plant features numerous unique manufacturing techniques and controls.

California Chemical International, Inc., was recently formed to take over the expanding export market of Oronite Chemical Co. Like its sister company, Oronite, the new firm will be a subsidiary of the Standard Oil Co. of California. It will have executive offices in San Francisco and branch offices in Geneva and Panama City. Oronite, a leading supplier of petrochemicals for industrial use, exports a broad range of products throughout the world. These include Alkane, a basic detergent raw material; lubricating oil additives, paraxylene, phenol, acetone, isophthalic, polybutenes, and gas odorants. The new company will replace Oronite's export division, but will be organized on a much broader basis. Much of the personnel will come from Oronite.

Monsanto Chemical Co., St. Louis, Mo., has purchased the physical assets of Filtered Rosin Products, Inc., Baxley, Ga., a manufacturer of paper size and other gum rosin products. The acquisition will continue to operate as a separate and newly formed Filtered Rosin Products Co., employing the personnel of the former company. Robert M. Morris, assistant general manager of Monsanto's organic chemicals division which made the purchase, has been elected president of the new company in addition to his Monsanto duties.

The Sun Rubber Co., Akron, O., is reporting recent infringement of the company's copyright and trade mark rights by foreign manufacturers of dolls and toys. In a statement recently issued, Sun cautioned doll and toy distributors and dealers of the infringement and of the possible use, unknowingly, of such illegally produced merchandise.

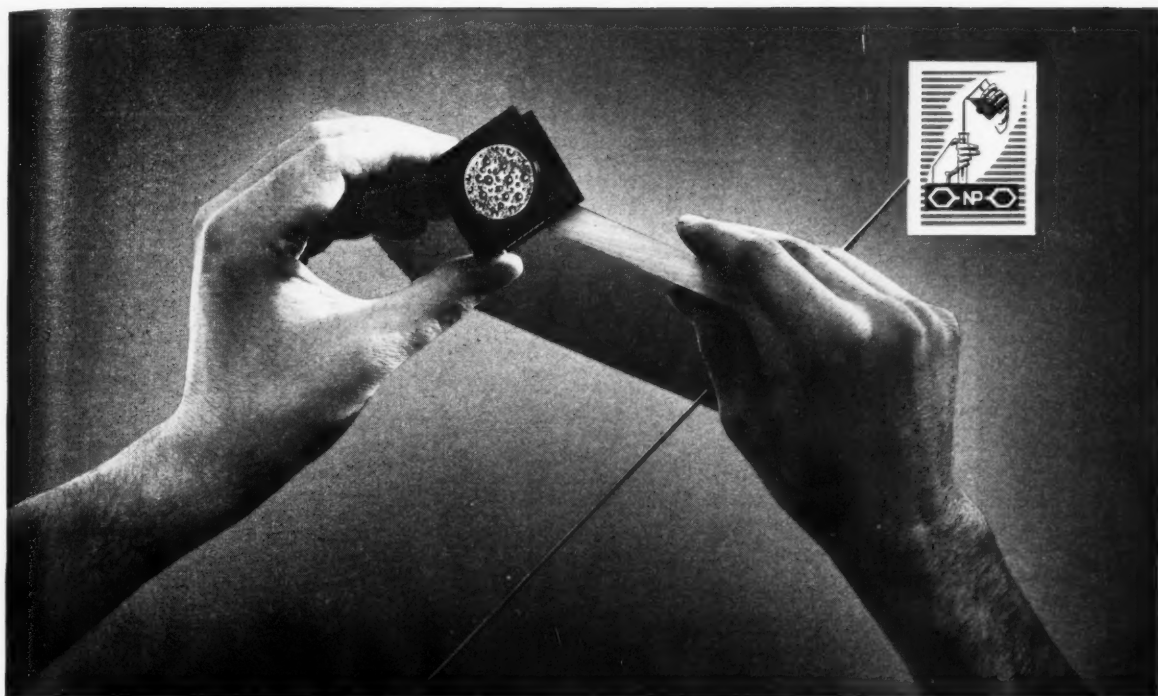
Stewart Bolling & Co.'s president, Stewart Bolling, has been granted United States patent No. 2,820,618, for an arrangement of driving rotors of intensive mixers independently, which thereby eliminates connecting or differential gears and makes front and back rotors interchangeable. As is generally known, the time cycle of plasticizing or fluxing of rubber and plastics, as well as even and fast dispersion of fillers and pigments, can be materially decreased by increasing rotor speed and chamber pressure. The power increase is proportional, and owing to limited centers of rotors, connecting gears in many existing machines have, with the fourfold or more increases in power, already passed their practical limits, it was said.

The B. F. Goodrich Co., Brecksville, O., has installed a new 7,200-pound mass spectrometer at its Research Center. The instrument, manufactured by Consolidated Electrodynamics Corp., Pasadena, Calif., investigates unknown gases and liquids by mass spectral analysis obtained by bombarding with electrons the sample molecules of the unknown material.

American Latex Products Corp., Hawthorne, Calif., is manufacturing more than \$41,000 worth of the company's special foam rubber cushions for installation in the reserve and box seats of the Los Angeles Dodgers' mammoth Coliseum. The weather-proof, vinyl-covered cushions will be 1½ inches thick, 9½ inches deep, and 90 inches long, with a capacity of four persons.

The General Tire & Rubber Co., Akron, O., has announced a new truck tire, the Traction Rib Special Service, that is said to give up to 10% greater original mileage than the tire it replaces, with no change in price structure. This new tire has a wider, deeper tread than the highway tire which it supersedes; while the tire body is of the same standard construction. The new tire is being offered to fill a growing need among truck operators for longer original tread service on all the tires they purchase.

The Borden Chemical Co., Peabody, Mass., has announced a new Reswax concentrate identified as M-1200. Produced by the company's coatings and adhesives department, M-1200 is a concentrated blend of butyl rubber and microcrystalline wax. It was developed especially as an additive to microcrystalline wax in the coating of heat-seal labels, for the lamination of glassine to boxboard, and for the lamination of glassine to itself. The new M-1200 also was developed for use by wax refiners who make refinery cuts of butyl in microcrystalline wax.



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 **NATIONAL POLYCHEMICALS, INC.**

Wilmington, Massachusetts

B. F. Goodrich Aviation Products, Akron, O., has developed high-speed tires for the DC-8 jetliners now in production at the Douglas Aircraft plant, Long Beach, Calif. Two dual nose wheel tires and four tires on each of the two main landing gear are qualified at 200 miles per hour. All are tubeless. Each main landing gear assembly weighs 3,400 pounds. The four ribbed-tread tubeless tires on each main gear are identified as Type VII. Each is 44 inches high with a 26-ply rating. Dual tires on the nose wheels have the same tread design and are 34x11 with 18-ply rating. Each main wheel tire, carrying air pressure of 165 pounds per square inch, is designed to support a static load of 35,500 pounds.

Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn., has concluded a marketing agreement with Russell Reinforced Plastics Corp. to distribute nationally reinforced plastic panels for decorative and architectural use. The Division is a major producer of polyester resins used in reinforced plastic molding. Russell Reinforced, which operates manufacturing plants in Lindenhurst, N. Y., and Boca Raton, Fla., has pioneered in the development of the colorful, translucent and weather-resistant plastic panels.

The Goodyear Tire & Rubber Co., Akron, O., has appointed three firms as distributors of Rubarite for use in tar and asphalt for road surfacing applications. Rubarite is a coprecipitate of synthetic rubber and a mica-type carrier and is marketed as a finely divided powder. The firms named were Borne Chemical Co., Inc., Elizabeth, N. J.; Flesch-Miller Co., Indianapolis, Ind.; and Servisised Products, Inc., Chicago, Ill.

The Chemstrand Corp., New York, N. Y., has announced the commercial production of a new-type nylon tire and industrial yarn. This yarn is known as the RHB type, offering greater strength, higher thermal resistance, and better adhesion values than tire yarns currently available. It is being offered in 840 denier and 140 denier filaments.

Military Clothing & Textile Supply Agency, Philadelphia Quartermaster Depot, U. S. Army, has made two awards resulting from bid QM 36-243-58-434, covering overshoe, rubber, man's, high, black, five-buckle. The contractors were The Rubber Corp. of California, Garden Grove, Calif., to produce 5,952 pairs @ \$3.94 each for a dollar value of \$23,450.88; and LaCrosse Rubber Mills Co., LaCrosse, Wis., to produce 25,728 pairs @ \$3.94 each for a dollar value of \$101,368.32. The procurement is for the U. S. Armed Services.

Columbian Carbon Co., New York, N. Y., now offers three standard types of hardwood pallets for convenience in handling unitized carload and truckload shipments of the company's carbon blacks in bags. By standardizing, Columbian is able to offer these 40- by 48-inch pallets at \$1.25, \$2.00, and \$3.00 each. These prices include a covering of corrugated fiberboard over the pallet to protect the bottom layer of bags from snags and nails.

The Firestone Tire & Rubber Co., Akron, O., recently produced its 50,000,000th tubeless tire at the Akron plant. Tubeless tires now account for virtually 100% of original-equipment passenger tires and for a major portion of replacement tire business. It was reported that tubeless tires have introduced a new era of safety in automobile transportation. The tubeless tire was called the greatest advance in tire engineering since the development of the balloon tire in the early 1920's. More tubeless tires will be sold for the replacement market in 1958 than in any previous year, it was predicted.

Albert Frank-Guenther Law, Inc., New York, N. Y., has been appointed by Commodity Exchange, Inc., New York, for a public relations program to acquaint the public and inform dealers, producers, and processors of the facilities and economic functions of the Exchange.

Cia. Italiana Nest-Pack S. P. A., Bolonga, Italy, has signed a license agreement with The Pantasote Co., Passaic, N. J., for the manufacture of plastic packaging materials developed in Italy. The agreement enables Pantasote to use the production methods, process, and special machines built by the Italian company for the manufacture of plastic packaging materials in the United States. Pantasote will commence production of this material, using kohinor resin of its Eleonora division, at its Passaic plant under the trade mark Panta-Pak. One of the first applications of Panta-Pak will be commercial fruit packaging.

Richard Best Pencil Co., Springfield, N. J., has introduced a new lead pencil that is said to be an improvement over the grease pencil for marking on rubber or plastic products. It works equally well on both glossy or matte surfaces, it is claimed. It can be pointed in any pencil sharpener and is excellent for layout work as well as pricing and cost marking. The brand name is Tag and sells for \$1.75 per dozen. The manufacturer advises that Tag can be furnished in quantities imprinted with firm name or advertising slogan for use as a public relations or advertising medium. Samples are available for testing.

Monsanto Chemical Co., Springfield, Mass., has consolidated five marketing functions into an expanded market development department at its plastics division. Theodore S. Lawton, formerly an assistant director of sales, has been promoted to director of market development, will head the new department, and will coordinate these staff activities: advertising and sales promotion, automotive sales development, creative design, industrial and building applications, and market research. It was also announced that Ralph F. Hansen, formerly manager of market development, has been promoted to assistant director of market development, reporting to Lawton.

B. F. Goodrich Tire Co.'s president, E. F. Tomlinson, recently said in Akron that replacement tires for foreign passenger cars imported for sale in the United States will represent an estimated annual sales potential for tire retailers of \$28,000,000 by 1960. In 1958 the replacement potential is in the neighborhood of \$8,000,000, he said. He estimated that there are 400,000 foreign passenger cars registered in the U. S. today and that this figure is expected to increase by 300,000 this year. Goodrich recently announced that tires and tubes to fit popular foreign cars sold here are available through its dealers and stores.

Technical Rubber, Inc., West Haven, Conn., is manufacturing a new offset blanket in three- and four-ply construction in red, black, and green. The company advises that its neoprene and Hypalon coated nylon fabrics sold under the trade name of Tech-Tarp for tarpaulined cover materials is being accepted universally for its high standards of quality. The firm specializes in coating natural and synthetic fabrics to meet highly technical and rigid government and private industry specifications.

A complete rubber mill, fully assembled, weighing about 28 tons, has reached the United States from Britain. This is believed to be the first machine of its type to be imported here as a packaged mill. It arrived in Boston recently and has been delivered to its purchaser, Apex Tire & Rubber Co., Pawtucket, R. I. It arrived ready to run in one piece and needs only to be rolled into position and connected to electric and water supplies. The speed of shipment was made possible by the cooperation of Reed Brothers (Engineering) Ltd., London, England, and several British subcontractors, who supplied the switchgear, motor, and gearbox.

Interchemical Corp.'s Color & Chemicals Division has been moved to Hawthorne, N. J.

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ASRC 1502	Non-Staining	ASRC 1001	Slightly Staining
ASRC 1503	Non-Staining	ASRC 1004	Staining
ASRC 3110	Non-Staining	ASRC 1006	Non-Staining
COLD OIL		ASRC 1009	Non-Staining
ASRC 1703	Non-Staining	ASRC 1018	Non-Staining
ASRC 1708	Non-Staining	ASRC 1019	Non-Staining



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NEWS

about PEOPLE

Fred C. Traflet has joined U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y., as a special consultant in product development and market analysis.

Mark G. Magnuson is now southeastern district sales manager, and **W. Fraser Malcolm**, New England district sales manager of National Lead Co.'s Titanium Pigment Corp. Magnuson will headquarter in Atlanta, Ga., and Malcolm, in Boston, Mass.

Gordon A. Vannah has been named Boston district manager for B. F. Goodrich Industrial Products Co., Akron, O. He succeeds **Raymond P. Russell**, recently appointed sales manager of B. F. Goodrich Flooring Co., Watertown, Mass.

Carl W. Brodt has been named plant manager of the newly created Firestone Rubber & Latex Products Co., Fall River, Mass. Mr. Brodt has been with the Fall River development department for 20 years. He will be succeeded as development department manager by **Carlton H. Yates**, who joined the department in 1950.

J. D. Hershey has been named director of public relations for the Dayton Rubber Co., Dayton, O., succeeding **Ray L. Wetzel**, who retired March 1. Hershey was formerly director of sales promotion and advertising.

Oka Carlson has been appointed manager of The Goodyear Tire & Rubber Co.'s new plastics plant at Apple Grove, W. Va., effective March 17. He will have headquarters in Akron until the \$9,000,000 installation goes into production early in 1959. When completed, the Apple Grove unit will produce Videne, the new polyester film recently announced by Goodyear.

E. A. Orem has become associated with Amoco Chemicals Corp., Chicago, Ill., as a sales consultant. Mr. Orem, who retired last December after many years as head of industrial chemical sales for du Pont's Grasselli Chemicals department, is well known throughout the chemical industry.

William O'Neill, president of The General Tire & Rubber Co., Akron, O., has agreed to serve as a vice chairman of the 1958 Special Gifts Campaign of the National Conference of Christians and Jews, New York, N. Y., it was announced by **General Robert Wood Johnson**, board chairman of Johnson & Johnson, who is serving as chairman of the drive. In this post Mr. O'Neill will help lead a country-wide effort to raise funds required to finance the organization's program of promoting good will among Protestants, Catholics, and Jews.

Curtis L. Moody, production planning manager for the tire division, United States Rubber Co., New York, N. Y., is retiring after 28 years of service. He was factory manager of the Detroit plant, largest in the tire industry, for 17 years. As division production manager for several years, he was responsible for operation of the company's five tire plants.

Marvin R. Huffman recently joined the quality control laboratory at the Charleston, W. Va., plant of Union Carbide Chemicals Co., division of Union Carbide Corp. Previous to joining Carbide, he had served in the Armed Forces.

Philip H. Zuiderhoek, manager of B. F. Goodrich Tire Co.'s Tuscaloosa, Ala., plant for the past 10 years, has been named Akron, O., tire plant superintendent. **Fred N. Lehmann**, Akron tire plant superintendent since August, 1956, has been made manager of the Tuscaloosa plant.

John C. Milne has been named product manager for compound-applying machinery, container products department, Dewey & Almy Chemical Co., division of W. R. Grace & Co., Cambridge, Mass.

Robert L. Duncan has been appointed sales manager of Union Carbide Chemicals Co., division of Union Carbide Corp., New York, N. Y. Prior to assuming management of Carbide's field sales force, he was assistant sales manager.



Personal Studio

Eric E. S. Campbell

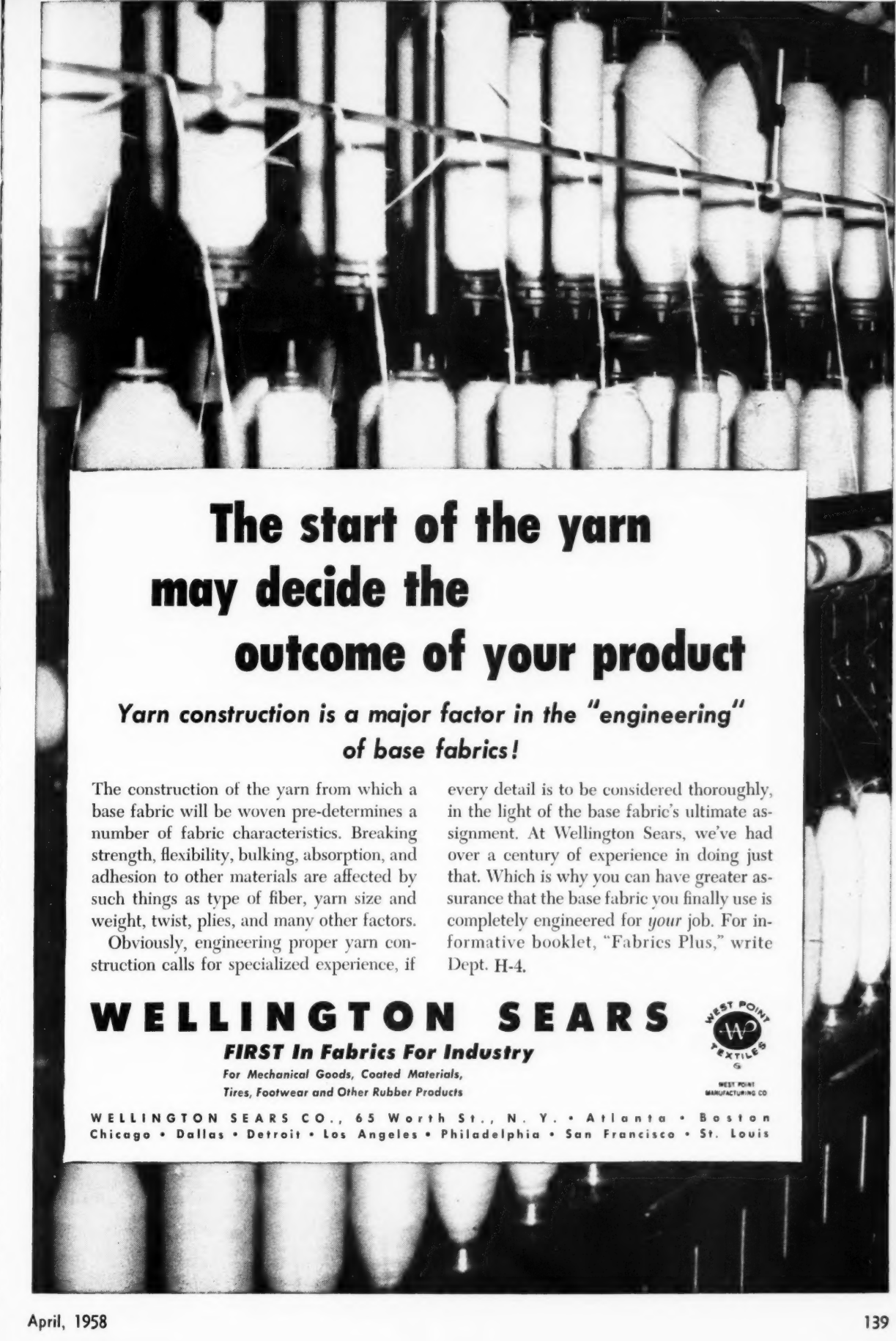
Eric E. S. Campbell has been named technical sales representative, rubber chemicals, for Naugatuck Chemicals, division of Dominion Rubber Co., Ltd., Montreal, P.Q., Canada. He will headquarter at the Naugatuck general offices in Elmira, Ont., and will service the division's rubber chemical accounts in the central Ontario area.

Roy N. Phelan and **W. M. Anderson** have been elected to the board of directors of Gross Mfg. Co., Inc., Monrovia, Calif. Phelan fills the vacancy on the board caused by the recent death of **D. T. Starr**. Mr. Anderson succeeds the deceased as president; while **M. W. Starr** has been elected secretary-treasurer.

John C. De Belle has been named technical service representative for the chemicals division of Canadian Industries, Ltd., Hamilton, Ont. He will make his headquarters at Toronto, Ont., and will provide technical service to industry in that area.

Earl Mashburn has been appointed assistant vice president of Ro-Search, Inc., Waynesville, N. C., with the specific responsibility of coordinating and dealing with inquiries and problems arising from the use of that company's Process 82 for vulcanized footwear in America. The enormous interest shown by the footwear manufacturing industry in the U.S.A. in Process 82 has made it necessary for Ro-Search to expand its staff and its manufacturing facilities.

William H. Matz has been promoted to supervisor, quality control for the chemical group, Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.



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*Yarn construction is a major factor in the "engineering"
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News about People

C. Chester Bassett, Jr., vice president-sales, resigned from American Enka Corp., New York, N. Y., effective February 25. The office of vice president-sales has been discontinued, and sales activities will continue under the direction of **J. L. Bitter**, vice president-marketing. Bassett became general sales manager of the firm in 1954 and was elected sales vice president last year.

George H. Quinn and **Russell J. Martin, Jr.**, received new appointments in Detroit automotive sales from Landers Corp., Toledo, O. Quinn has been named manager of all the Detroit automotive sales. Martin will report to Quinn and be responsible for the company's interests at Ford Motor Co. and all of its divisions. Landers manufactures vinyl upholstery and convertible topping for the automotive industry, upholstery fabrics for the furniture and marine markets, and is a basic supplier of coated material to the glove industry.

Henry A. Haas has been named sales manager, automotive accessory division, Bearfoot Airway Corp., Wadsworth, O. He was formerly associated with The General Tire & Rubber Co., Akron, O., as manager of material and equipment sales. He will be responsible for all sales, merchandising, and advertising of Bearfoot's rapidly expanding automotive division, with particular sales emphasis on attachable white sidewalls for automobile tires.



C. P. Moore

C. P. Moore has been appointed special representative for the chemical division, The Goodyear Tire & Rubber Co. With headquarters in Charlotte, N. C., he will service rubber, plastics, textile, paint, and paper processing accounts in both North and South Carolina.



Edward F. Kiernan

Edward F. Kiernan has been added to The Goodyear Tire & Rubber Co.'s plastic film and sheeting sales staff. He has headquarters in Akron and is responsible for coordinating and promoting sales of the firm's new polyester laminating film. Videne A.

J. M. Allison has been appointed vice president, operations, and **J. B. Prendergast**, vice president, marketing, Gutta Percha & Rubber, Ltd., Toronto, Ont., Canada.

R. E. Dyer has been appointed special representative for the chemical division, The Goodyear Tire & Rubber Co., Akron, O. With headquarters in Cleveland, Dyer will provide sales and technical service to accounts in the Mid-Central States. His division markets high polymer rubbers, resins and latices to rubber, plastics, paint, paper, and textile industries.



R. E. Dyer

F. A. Bozzacco has been named sales engineer with the coatings department of The Goodyear Tire & Rubber Co.'s chemical division, Akron, O. In this position, he will be directly responsible for technical service activities concerning Pliolite rubber latices. Available as copolymers of styrene-butadiene or polymers of butadiene, Pliolite rubber latices in both high and low solids content exhibit a wide range of physical properties.



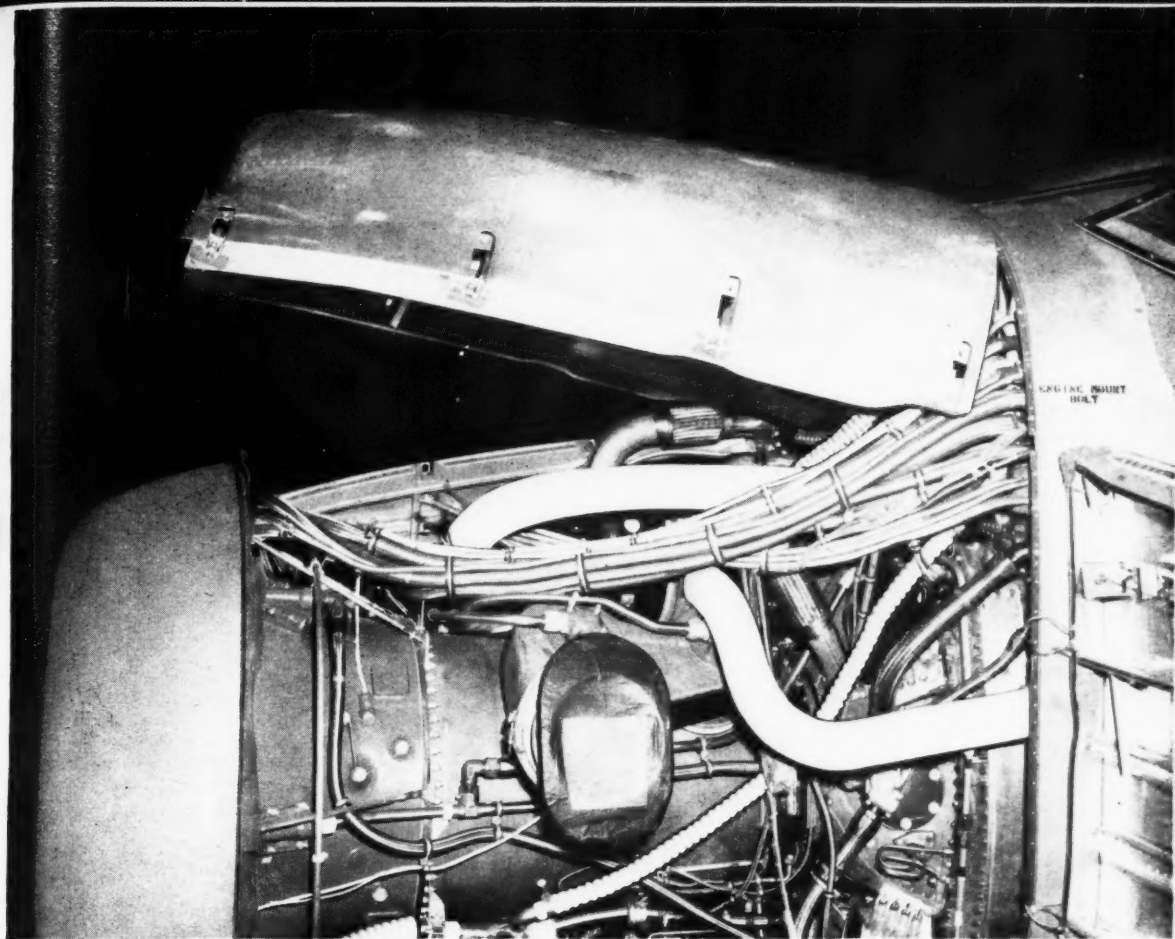
F. A. Bozzacco

Robert S. Parkins has been appointed staff development engineer for The General Tire & Rubber Co.'s chemical division, Akron, O. Formerly assigned to General's Ashtabula, O., chemical plant as senior process engineer, he had joined the company in 1954.

Richard C. Feaster has been made sales representative covering the Philadelphia area for the polychemicals division, West Virginia Pulp & Paper Co., Charleston A. S. C. At the same time **George J. Tazelaar** was named sales representative for the Cleveland, O., area.

Gale F. Muchmore has been named to the newly created post of products manager, rubber and all-vinyl tile, it was announced by Carl Resnikoff, vice president in charge of marketing, Mastic Tile Corp. of America, Houston, Tex.

Robert F. Hill has been named sales manager for Eleonora Chemical, a division of The Pantasote Co., Passaic, N. J., and New York, N. Y. He will be in charge of the resin sales department. He was formerly assistant sales manager of the vinyl resin department of Monsanto Chemical Co. and has been associated with the vinyl resin industry for more than eight years.



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Makes Hose Serviceable From -100 to +500F

**TYPICAL PROPERTIES OF
HOSE, DUCTS AND TUBING COMPOUND
MADE WITH SILASTIC 432 BASE**

	Cured 24 hrs at 480 F	Aged 24 hrs at 600 F
Temperature range, degrees F	-100 to	+500
Specific Gravity		1.27
Hardness, durometer	55	60
Tensile Strength, psi	850	770
Elongation, %	250	200
Compression Set, percent, 22 hrs at 300 F	20	18

Properties obtained on 1/8" ASTM slabs
or buttons, molded 5 minutes at 240 F.

The compounding of stocks with superior physical properties for hose, ducts and tubing is easier with Silastic* 432 Base. This partially-compounded silicone rubber gum requires no bin aging after compounding, is easy to calender onto glass, dacron or nylon and can be dispersed in solvents for spread, dip or flow-type coatings. All compounds made from Silastic 432 Base retain remarkable resistance to extreme temperatures and abrasion. They have high tensile strength, good elongation and low compression set.

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News about People

Harry S. Alderson has been appointed manager, B. F. Goodrich, Canada, Ltd., Kitchener, Ont., for Koro-seal pipe sales in addition to his former responsibilities as manager of BFG rubber-to-metal applications. **Arnold J. Reed** has been named section manager, compounding, of the industrial products division; while **Ransom H. Vrooman** has been appointed section manager, compounding, of tire and tube division, Goodrich Canada.

Maurice O'Connor and **Joseph Ross**, of O'Connor & Co., Inc., Chicago, Ill., have been named Midwest sales representatives for U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.

Donald B. Hefner has been named field representative for Goodyear Tire & Rubber Co.'s packaging films at Charlotte, N. C. Prior to joining Goodyear's films and flooring division as a films sales trainee in 1957, he had been associated with Goodyear since 1950 as a member of the production training squadron.

S. William Riley has been appointed chief project engineer for the Quaker Rubber division, H. K. Porter Co., Inc., Philadelphia, Pa., and will be responsible for all engineering project work, machine design and development. He was previously with the McNeil Machine & Engineering Co. as design engineer and The B. F. Goodrich Co. as supervising engineer. He has been associated with the rubber industry for the past 16 years.

William E. Boruff has joined the staff of The General Tire & Rubber Co.'s chemical division as sales development engineer. His responsibilities will include the evaluation and recommendation for sale of new products intended for the chemical division at Akron, O.

Art Ireland has been appointed chief chemist at Pitman Products, Huntington Park, Calif.

Charles M. Scholz, general sales manager of The Landers Corp., Toledo, O., was recently elected vice president for marketing. He spent 15 years in the rubber and plastics field prior to joining Landers in 1957. Most recently he was vice president and general manager of the rubber division of The Thermoid Co.

Arthur Goldman has joined the Kenrich Corp., Maspeth, N. Y., as technical representative. Goldman, well known in the rubber and plastics industries, will concentrate his efforts in the eastern states.



L. O. Crockett

L. O. Crockett, a director, has been elected president and chief executive officer of Goodrich-Gulf Chemicals, Inc. He succeeds **W. I. Burt**, now chairman of the board. Crockett, vice president, petro chemicals, Gulf Oil Corp., will leave that company and undertake active direction of Goodrich-Gulf at its headquarters in Cleveland, O.

Howard C. Sommer has been named, director of sales of The General Tire & Rubber Co.'s industrial products division, which includes plants at Wabash, Logansport, and Marion, Ind., and Welland, Ont., Canada. He will headquarter at the division's general offices at Wabash. Prior to joining General Tire, he was associated for 28 years with the Dryden Rubber division of Sheller Mfg. Corp.

George E. Martin and **Theodore Kahan** have been elected vice presidents of Aldan Rubber Co., Philadelphia, Pa. Martin heads the company's technical sales and service division, and Kahan is in charge of research and development.

James E. Martin has been named manager, material and equipment sales, The General Tire & Rubber Co., Akron, O. Martin replaces **Henry A. Haas**, who has resigned.

John D. Gans, formerly merchandising manager for Rubbermaid, Inc., Wooster, O. has been named manager of the company's expanding commercial sales division. The division is now in a position to offer a greatly expanded line including rubber, plastic, wire, and vinyl products, and continuous rubber matting for stationery, hotel, hospital, and other institutional fields.

H. G. Campbell has been made sales manager of the chemicals division of Canadian Industries, Ltd., New Toronto, Ont. He succeeds **Gordon D. Pratt**, who will serve as a sales consultant for the division.

Kenneth H. Meyer has been elected vice president of C. B. Hunt & Son, Inc., Salem, O., manufacturer of Quick-As-Wink air and hydraulic control valves and pressure specialties.

C. L. Metzger has been named manager of the retreading and equipment sales division for The Goodyear Tire & Rubber Co., Akron, O. He succeeds **Harry T. Goodenberger**, who has left the company.

Raymond Stevens, president of Arthur D. Little, Inc., Cambridge, Mass., has assumed the duties of chief executive officer of that industrial research company. **Allen Latham, Jr.**, vice president of engineering, was elected a director; while **Earl P. Stevenson** continues as chairman of the board of the Arthur Little organization.

Robert T. Croysdale has been appointed factory manager of Ace Rubber Products, Inc. The Akron, O., company manufactures automotive and household mats and matting, and Croysdale has been placed in complete charge of production. Prior to joining Ace, he was plant manager of Phoenix Mfg. Co., Joliet, Ill.

Ray B. Ralph, widely known in the field of personnel administration, has been appointed personnel manager of the Oliver Tire & Rubber Co., Oakland, Calif. The company manufactures tire tread rubber, automotive rubber assembly parts, and rubber components for other industry.

Everett G. Harvey becomes sales engineer for the Quaker Rubber division, H. K. Porter Co., Inc., Philadelphia, Pa. He will concentrate primarily on O.E.M. accounts and coupling manufacturers in order to increase sales of Quaker's new molded hose constructions. He comes to Quaker with 15 years of experience in hose research and development. He was formerly with Boston Woven Hose as manager of the hose research and development department and with Gates Rubber Co., Denver, Colo.

John G. Sibley has been appointed to the newly created post of southern regional manager of Jefferson Chemical Co., Inc., New York, N. Y. At the same time **Wm. P. Thorp III** was designated resident salesman at the company's Charlotte, N. C. office.

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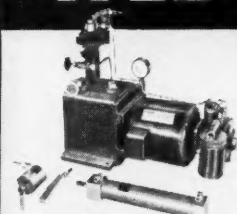
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to all your guiding problems in this complete line of automatic guiding equipment—employing exclusive features and principles that make Fife the most accurate and versatile guiding equipment in the world:

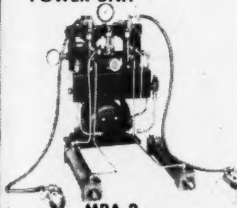
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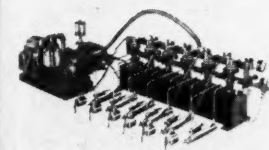
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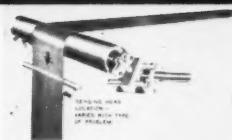
MPA-2
MULTIPLE POWER UNIT



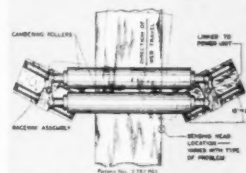
MPA-6
MULTIPLE POWER UNIT



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News about People

Floyd B. T. Myhre has been appointed assistant to the president, in charge of Witco Chemical Co.'s Washington office. Captain Myhre, U.S.N. retired, will serve as Washington representative for Witco and all its divisions including Ultra Chemical Works and Emulsol Chemical Corp. His office is at 734 15th St., N.W., Washington 5, D. C.



Floyd B. T. Myhre

Juan N. Mirabal, who has been directing sales of shoe products and sundries for International B. F. Goodrich Co., Akron, O., ended more than 26 years of service with the company when he retired March 1. He has handled advertising and promotion translations for all International BFG Spanish-speaking countries in addition to his sales responsibilities.

Charles F. Smith has been appointed manager of the sponge rubber division of American Bilrite Rubber Co., Chelsea, Mass. According to Smith, **Charles S. Marlbor**, formerly of United States Rubber Co., has been appointed sales representative for the company's sponge rubber division in the New England and Middle Atlantic States.

Frank G. Hager is now manager of truck tire sales, succeeding **O. K. Feikert**, who recently became assistant sales manager of Seiberling Rubber Co., Akron, O.

Harry C. Cookson has been named manager of personnel and service operations for the tire division, United States Rubber Co., New York, N. Y. Cookson, formerly manager, personnel and salary administration, will be responsible for all personnel services including management development, sales compensation, and salary administration.



James P. Drury

James P. Drury has been appointed superintendent of automobile floor mat production at Seiberling Rubber Co., Akron, O. For the past seven years he was production control manager of the company's tire division.

Douglas G. Sinclair, sales manager of the Canadian subsidiary company of Rubbermaid, Inc., for the past two years, has been elected a director of Rubbermaid (Canada) Ltd., Cooksville, Ont.

Harry Fishman of E. I. du Pont de Nemours & Co.'s elastomer chemicals department, has been assigned as a technical representative to the company's Boston district. Previously he had worked for two years in Du Pont's elastomers laboratory, where he did technical service work, and for a year as a sales correspondent.



Lombardi

Harry Fishman

Giulio Natta, a professor of the Polytechnic Institute of Milan, Italy, has been unanimously elected a fellow of the New York Academy of Sciences in outstanding recognition of his achievements in science. Election to Fellowship is a distinguished honor, conferred on a limited number of members who, in the estimation of the council of the Academy, have done outstanding work toward the advancement of science. The election was a result of Professor Natta's continuous meritorious scientific activities and, in particular, in recognition of his latest revolutionary discoveries in the field of polymer chemistry—stereospecific polymerization of olefins and diolefins—brought recently to light by the introduction of isotactic polypropylenes.

Chester J. Noonan, vice president of United States Rubber Co., has accepted chairmanship of the rubber products division of the New York Chapter's 1958 Red Cross Campaign, according to **O. V. Tracy**, chairman of the heavy industry section. **Richard Meehan**, executive vice president of H. Muehlstein & Co., Inc., is chairman of the crude rubber brokers and importers division of the New York Chapter's campaign.

Forrest W. Shaver has been named senior scientist, chemicals research department, at The B. F. Goodrich Co. Research Center, Brecksville, O.



Howard Johnson

Howard Johnson has been appointed southern regional manager for the Richardson Scale Co., Clifton, N. J., with headquarters at 423 Grant Building, Atlanta 3, Ga. He replaces **Ernest C. Mott**, who is retiring after 39 years with the company. In his new position, Johnson will be in complete charge of Richardson operations in the South from North Carolina to Texas.



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Manufacturers of quality lacquer products for industry, equipped to fill your lacquer needs quickly and economically.

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- NEW, improved LACQUERS for Rubber Footwear, or any rubber product where lacquer is used as a pre-cure coating.
- SOLE and HEEL LACQUERS. Eliminate seconds by using our special pigmented lacquers. Can be supplied in any color desired.
- NCP 1909. An anti-tack coating. Spray or brush it on any tacky surface where powder is normally used to kill tack before cure.
- CASUALS, footwear. NCP 1909 is an excellent dulling and anti-tack agent on edges of soles or crepe wrappers used in the manufacturing of casual type footwear.
- SPECIAL lacquers for all types of rubber products.

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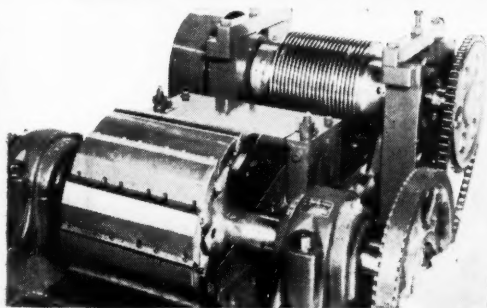
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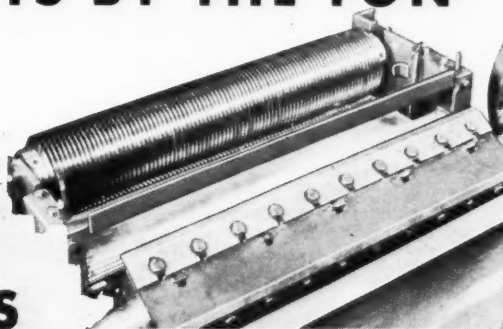
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from
RODS
or
SHEETS



Producers of pellets from sheets or extruded rods find that Taylor-Stiles machines, engineered to their specific requirements, give them an end product in the exact form they need.

The 700 Series, shown at the left, in widths from 6 to 14 inches, is available with or without circular knives. With circular knives it cuts rubber or plastic sheet stock into strips and then cross cuts it into pellets. Without circular knives it cuts extruded rods directly into pellets.

Models are available with 12 or 24 knives, length of cut up to $\frac{3}{4}$ ", speeds to 2400 rpm.

The machine shown at the right is Taylor-Stiles Series 200, made in widths from 18 to 42 inches, with or without circular knives. The machine illustrated takes 42" wide sheet and

then slits and cross cuts it into $\frac{1}{2}$ " squares. The length of cross cut on 200 Series machines may be almost any dimension from $\frac{1}{4}$ ", or even less, to 10" or 12" or even more.

Many of America's largest producers of rubber and plastic stock are turning to these Taylor-Stiles Dicing Cutters because they make less dust and feathers, require less power to operate and the knives stay sharper longer . . . all this while producing pellets of remarkably exact size.

We can supply the exact type of cutting head, slitting knives, and feed arrangement to meet your specific production need.

Write us today for our brochures illustrating and describing our continuous sheet, rod, or bar stock pelleters.

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NEWS

from ABROAD

Malaya

Recent Research

The Journal of the Rubber Research Institute of Malaya, Volume 15, Part 2 (1957), contains five articles accepted for publication in December, 1956, and during the first half of 1957.

In the first of these, "Stimulation of Bark Renewal of *Hevea*," P. de Jonge discusses an experiment in which the effects on bark renewal of vegetable and mineral oils, with or without the addition of 2,4-dichlorophenoxyacetic acid (2,4-D) are compared. Highly significant results were obtained only when 1% 2,4-D was used, and beneficial effects in all cases occurred mainly in the first year. The increased thickness of renewed bark following treatments appeared to be solely due to activation of the cork cambium; there was no increase of laticiferous tissue. At the same time there were increases in the yield of latex, but like the improvement in bark renewal, yield increase declined from year to year.

In "Microflora of *Hevea* Latex," D. H. Taysum deals with the methods devised for the culture of bacteria from fresh latex, ammoniated field latex, and ammoniated latex concentrate. The medium used was a modified Kligler's iron agar, which permits accurate evaluation of the numbers of bacteria present.

E. W. Bolle-Jones and R. N. Hilton, studying "Susceptibility of *Hevea* Seedlings to *Helminthosporium heveae*, in Relation to Their Nutrient Status," were able to confirm that an increase in the nitrogen supplied to rubber seedlings (either in the form of ammonia or nitrate salts) increased the severity of Birds' Eye Spot Leaf disease due to *Helminthosporium heveae*.

"Flame Photometric Determination of Potassium and Calcium and the Chemical Estimation of Phosphorus, Magnesium, and Manganese in Leaves of *Hevea*" are reported on by E. W. Bolle-Jones, V. R. Mallikarjuneswara, and K. Ratnasingam. They found that by the introduction of flame photometric methods for determining potassium and calcium, the usual time required for leaf analysis could be reduced by 33%.

The authors of the final paper, "Effects of Mineral Status and Light on

Rubber Formation in *Hevea*," by E. W. Bolle-Jones and V. R. Mallikarjuneswara, found that the formation of rubber in the stems of very young rubber seedlings increased with improved phosphorus supply, but that later this relation disappeared. They found that (1) more rubber per seedling was formed in the light than in the dark; (2) the effect of light on rubber formation was more important than that of mineral status; the effect of the latter was indirect; (3) the rubber content per plant, whether in light or in darkness, was closely related to the dry weight, total carbohydrates, and total proteins per plant.

Their observations led the authors to favor the theory that rubber, instead of being formed as a food reserve (as some investigators have suggested) is formed as a by-product of growth. Their conclusion is that any nutritional deficiency which impedes the optimal formation of carbohydrates and proteins within the plant will diminish the amount of rubber formed per plant. Here the micronutrient elements proved very important: absence of essential traces of these elements from the nutrient solution in tests decreased dry weight of the plant and its carbohydrate and protein contents; hence it is suggested that the fulfillment of the requirement of *hevea* for micronutrient elements may be an important factor in obtaining optimal rubber yields under field conditions.

Rubber Industry Future

Thanks chiefly to the rubber plantation industry, introduced by the British and largely financed and developed by them, Malaya has in the course of 50 years progressed from a poor, underdeveloped country to one of prosperity, enjoying the benefits of good roads and railways, postal and telegraph services, public buildings and schools, and other amenities. S. N. King, retiring chairman of the Rubber Producers' Council, said in a farewell broadcast. He added that while it would be an advantage to Malaya not to have to rely so much on rubber and tin, yet it was recognized that however much the country diversified its agriculture and industries, no other industry or collection of indus-

tries could take the place of rubber in Malaya.

This last observation in particular gives added point to a statement in the annual review of the Associated Chinese Chambers of Commerce on the tendency among European estate owners to "pull out of Malaya" and to transfer not only their money and energies, but more importantly their vast experience and knowledge of the rubber plantation industry to other countries, specifically, Nigeria. The Chinese organization expressed the fear that these companies might constitute Malaya's No. 1 competition in the world market, perhaps sooner than might be expected.

That big European rubber companies were pulling out of Malaya was denied by Mr. King, who cited the multi-million-dollar replanting scheme by European estates as proof of their faith in Malaya. The European replanted area has grown from 67,000 acres in 1955 to an estimated 100,000 acres in 1957.

Whatever the interpretation of the move, it is undeniable that no fewer than 16 European-owned rubber estates in Malaya were sold in 1957, against nine in 1956. These sales are in addition to acquisitions by other rubber companies and to voluntary liquidations, and a leading London authority has expressed the view that the process is likely to continue during 1958.

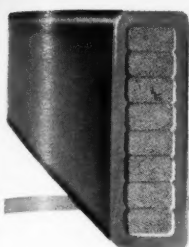
Trends and Outlook

Attention is called to a developing trend that may assume great importance—the appearance of Russia and China on the rubber market at critical moments. A market report in the *Straits Times* notes:

"Time and again during the downward movement when the main consuming markets were sitting on the sidelines, they have come into the market and stopped the rout.

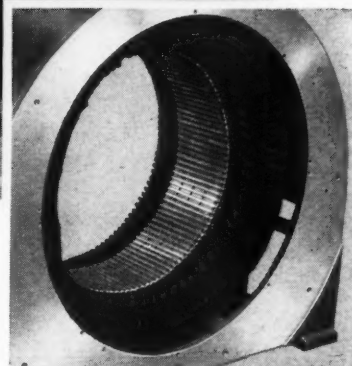
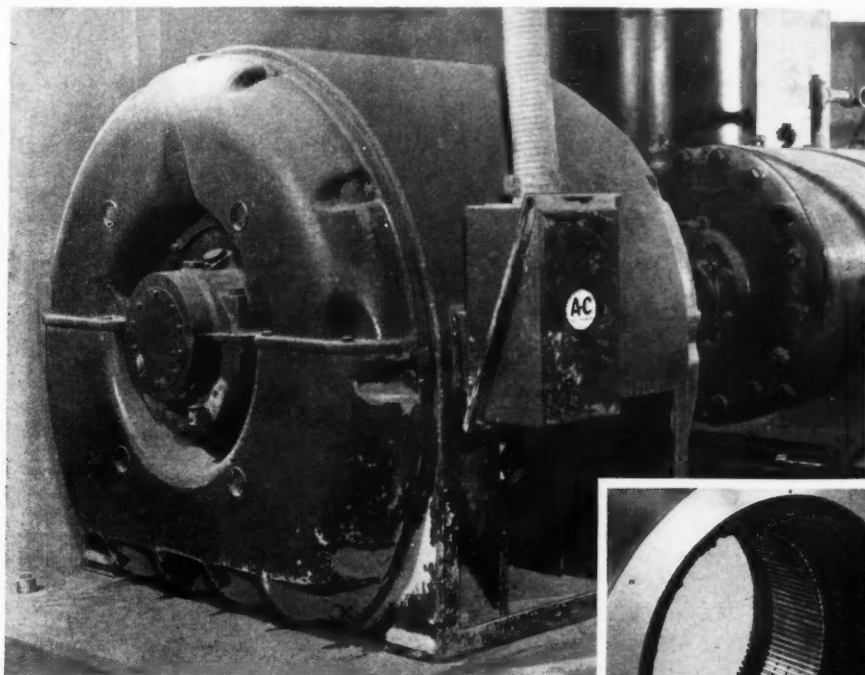
"In fact they are becoming more than useful customers as is Japan, and one can foresee those countries, in the not so distant future, becoming one of the dominating influences in this market."

Whether the effect of Russian and Chinese buying would have been so beneficial had conditions in Indonesia been normal is a moot point. During a visit to Malaya recently, Sir John Hay, chairman of Guthrie & Co., Ltd., the largest consolidated organization in the Malayan rubber industry, suggested that the reason rubber prices have not fallen significantly under the influence of the industrial recession and the low confidence involved has probably been the uncertainty of obtaining rubber from Indonesia in normal quantity. He also envisaged the possibility that the expectations on total consumption as calculated around the beginning of the year would not be realized.



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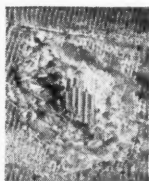
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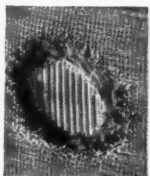
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The opinion of the Rubber Producers' Council on prospects, at least for rubber prices, was not more optimistic. In its recent annual report it stated that the "outlook for 1958 cannot be regarded with confidence owing to the world-wide depression in commodity prices," and it predicted lower prices for natural rubber this year.

A more cheerful note, though for the more distant future of Malaya, was sounded by H. T. Karsten, director of United Baltic Corp., Ltd., London, England, and chairman and director of a number of Malayan plantation companies. On a tour of Malaya he told the press in Singapore that the country's successful replanting program might well result in restoring Malaya to her former place of premier producer of natural rubber within ten years. He thought that Malayan output, which had reached nearly 639,000 tons in 1957, could come to a million tons by 1968.

On the other hand, he expected Indonesia, now the world's largest rubber producer, to show a decline, as she had undertaken very little replanting since the war. With regard to price, his opinion was that a competitive price of natural rubber would help to sell it, but that that was not enough, and his advice to Malayan rubber growers was to sell their product by going to their customers and explaining its advantages.

Aiding the Industry

The local press makes mention of two new schemes to protect the natural rubber industry. The president of the Federation of Rubber Trade Associations, Heah Joo Seang, urges the establishment of a Far Eastern Rubber Council, and that with this end in view, Malaya approach Indonesia, Siam, Burma, Ceylon, and Vietnam. Pointing to the highly organized rubber industry in America, Britain, and Europe, Mr. Heah stressed that the economic interests of Malaya were bound to suffer unless strong measures were taken to unite the industry. He went further, adding that the time had come when "all communal chambers of commerce, together with mining and planting associations should amalgamate into a single streamlined whole."

J. Vixseboxe, leader of the Netherlands delegation to the recent E.C.A.F.E. conference, suggested that Malaya and other rubber producing countries set up national funds to help the industry in lean times so that production could be maintained and unemployment prevented. The funds could, for instance, be raised by the imposition of a slightly higher tax on exports when prices were high. The measures taken must not "upset too much the economy and employment situation in the countries affected by low price"; nor should

they adversely affect conditions in other countries.

"Until the Rubber Study Group has finalized the French proposal (put forward at the last meeting held in Jogjakarta) to form an international rubber price stabilizing group, the various producing countries should make certain internal policies to cope with price fluctuations," he said.

Wage Talks

The latest available news on the wage talks suggests that there has been a certain hardening of attitude on the part of both the Union and the M.P.I.E.A. (the employers' organization). The latter has rejected the workers' minimum wage demands as being "quite unrealistic" and likely to double the industry's present wage bill of \$350,000,000 (Straits currency) annually, if granted. It has meantime become known that the Union is asking for a minimum wage of \$3.00 a day, plus a cost of living allowance of 60 cents a day, annual bonus, and special allowance for carrying latex; in addition it wants the normal daily "task" to be reduced to 350 trees and payment of two cents to the tapper for every extra tree he taps. At present the tapper gets \$3.30 a day for a normal task of 450 trees.

The M.P.I.E.A. told the Union that it was prepared to make the change from the present wage system to a minimum wage for tappers, but only on the understanding that there would be no overall increase in costs. It was prepared to go to arbitration on the matter, but only if the Union promised that there would be no strike, go-slow, or other form of pressure. The workers denied that their wage claims were unrealistic and moreover saw an implied "mild threat" in the M.P.I.E.A.'s conditions for arbitration. In retaliation for the rejection of their wage demands, the union leaders were understood to be planning to launch a country-wide go-slow campaign among the 320,000 rubber estate workers.

Industry Notes

The rubber replanting scheme expires at the end of 1959, by which time 500,000 acres should, according to the original target, have been replanted by smallholders. To the end of 1957 they had replanted 186,825 acres, and it does not seem likely that the total will be much more than 200,000 by the end of 1959. It is noted that total grants to smallholders have increased with the increase in the number of smallholders that has resulted from the fragmentation of larger estates, a trend expected to continue.

Smallholders can now obtain instruc-

tion in the selection of planting material and in the best methods of planting at a center established last August by the Rubber Research Institute in Negri Sembilan. The course takes a month and the cost, covering food and traveling expenses, comes to \$50 (Straits). This first venture seems to have proved itself, and two more centers are planned.

American firms have recently shown increased interest in the possibilities for investment in Malaya, it is locally reported, and word has gone around that an American tire manufacturing company may set up a large factory in the Kuala Lumpur area.

Rubber shoes imported from Japan and Hong Kong into Singapore are being sold at such low prices that local manufacturers cannot compete, and their existence is said to be threatened. Already manufacturers have had to reduce the work week to four and even three days, and they as well as unions representing workers in the rubber manufacturing industry here are appealing to the government for protective measures.

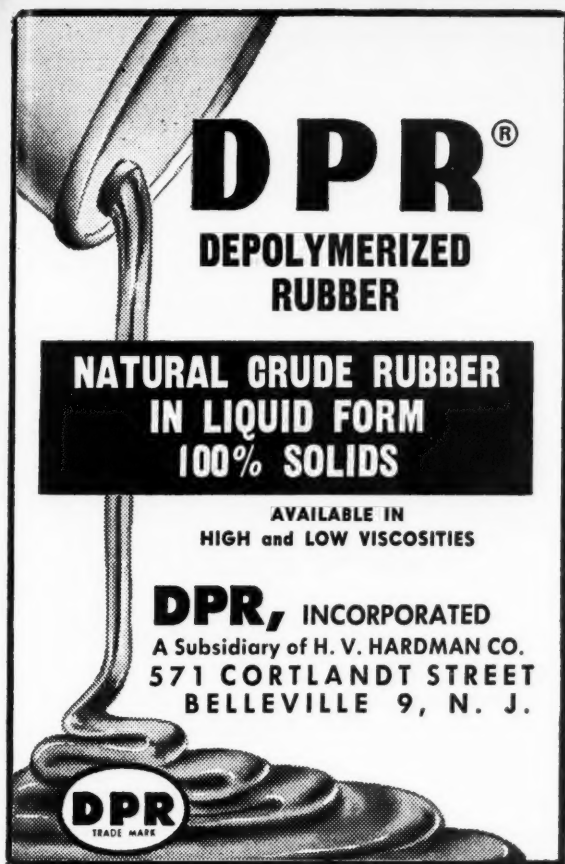
Burma

According to a recent press report, a Burmese trading company intends to buy 6,000 tons of rubber annually from Malaya, for reexport to Yugoslavia. The director of the company visited Singapore late in October to make necessary contacts with local rubber dealers. It appears that Burma does not produce enough rubber to enable her to export the quantities required from her own output.

Ceylon

A report from Colombo, published in the *Straits Times* of December 30, states that the Soviet Union has offered to buy Ceylon's entire rubber output at well over world market prices, for the next 10-15 years—provided Ceylon buys Soviet products. A Russian trade mission recently was in Ceylon to negotiate a trade pact with Premier S. W. R. D. Bandaranaike and other members of the cabinet.

Further details of the barter arrangements proposed by the Russians are not yet available, but according to the report, Ceylon officials are not eager to accept them. A Colombo paper is quoted as saying that while an exchange of goods between the two countries would be welcomed, Ceylon wanted no political strings attached. At the same time she wanted to maintain her policy of friendship and trade with Western countries.



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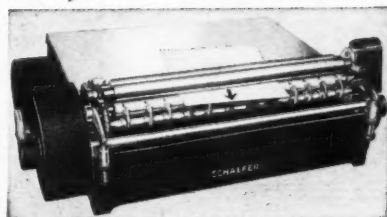
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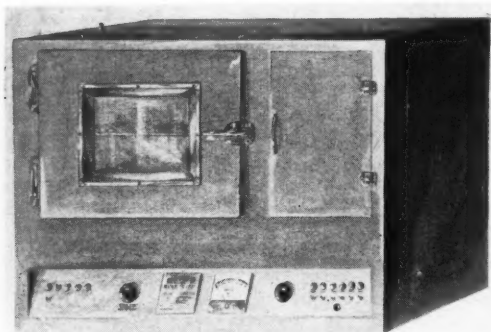
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NEW

EQUIPMENT



OREC 0300 ozone test chamber

Ozone Test Chambers

The new OREC 0300 series ozone test chambers featuring an entirely automatic control system have been announced by Ozone Research & Equipment Corp., Phoenix, Ariz. Provided with panel meter directly reading ozone concentration in pphm/volume for selecting desired ozone concentration in cabinet, these ozone test chambers operate continuously on a 24-hour schedule without the need of laboratory attendance.

To operate at any ozone concentration it is necessary simply to turn one dial to set the panel meter at the desired concentration. Because of the automatic ozone control system, ozone concentration maintains constant without regard to the number of samples in the chamber and the rate at which samples ozonize during the test. OREC 0300 conforms to ASTM D 1149-55T and all known ozone test specifications for the accelerated ozone cracking of rubber and other elastomeric vulcanizates. OREC 0300 provides the ozone concentrations required by ASTM D 470-54T, D 1352-54T, D 1373-55T, and IPCEA Wire & Cable Tests.

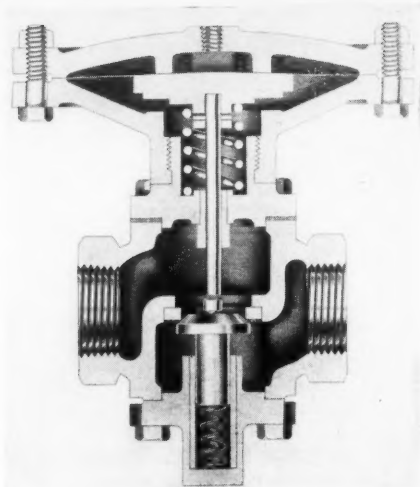
OREC 0300 series specifications include the following: bench model, 48 inches wide by 36 inches high by 25 inches deep; temperature range, 5° F. below ambient to 200° F. with $\pm 1^\circ$ F. Power-O-Matic temperature control; air circulation velocity over samples, 2 ft/sec.; air flow through chamber, up to two chamber changes of freshly ozonized air per minute; power requirements, 100-120 volts, 60-cycle, a.c. (integral 115-volt constant voltage regulator); exterior finish, pastel blue hammerloid enamel with all chrome hardware; interior, entirely stainless steel.

New Diaphragm Valve

To increase the scope of its solenoid valve line, the Johnson Corp., Three Rivers, Mich., has developed a new diaphragm valve. When coupled with the Johnson direct operated solenoid valve, which serves as a pilot, this new diaphragm valve provides automatic or remote flow control for higher-pressure applications.

This new diaphragm valve offers the same floating valve action featured in Johnson solenoid valves. The valve seat is separate from the push rod and is free to float to a tight seat; the valve is guided from overhead by an oversize stem fitted within a bronze bushing.

Designed and built for heavy-duty service, the new diaphragm valve is suitable for pressures up to 250 pounds. The body is of



Johnson Corp. diaphragm valve

cast-iron; diaphragm, of phosphor bronze; and valve, seat, and push rod, of stainless steel. The valve cap and the diaphragm housing are bolted to the valve body for extra strength and accessibility.

The Johnson diaphragm valve is available in two-, 2½-, and three-inch sizes—all screw connections. They can be used with steam, air, water, and other liquids; they are particularly suited for use with heavy viscous liquids. They can be furnished with solenoid valves that provide either normally open or normally closed service.

The Johnson solenoid valves used for pilot service are of the direct operated type. Conservatively rated coils, plus a unique leverage system, provide ample opening power. Their design places coils alongside, rather than directly above the line; consequently they can be used with liquids or steam up to 400° F.

The complete list of Johnson solenoid valves, including the new diaphragm valves, is described in a new 12-page bulletin available from the company.

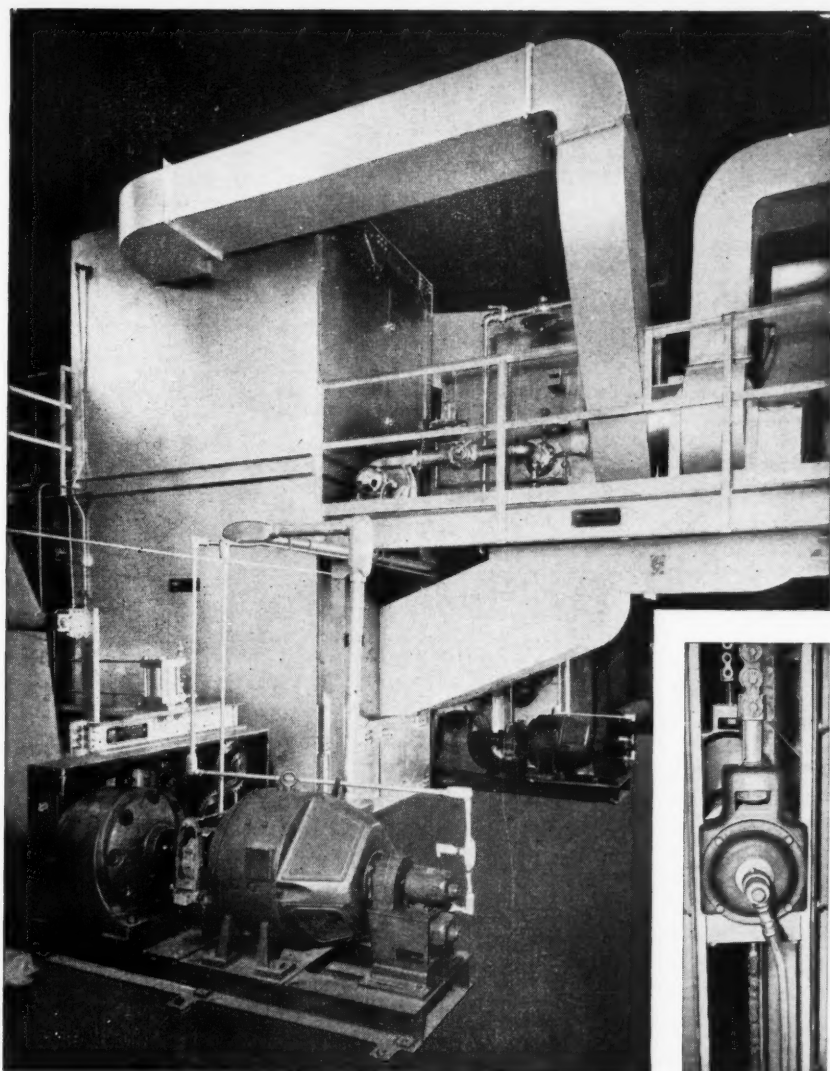
New Shore A-2 Durometer

The Shore Instrument & Mfg. Co., Inc., Jamaica, N. Y., has introduced a new elastomer hardness tester with two red tolerance hands, the Shore A-2 durometer, which is used for testing the indentation hardness of rubber and rubber-like materials.

The new instrument's (ASTM D 676-55T) tolerance hands (Code XATH) may be set by two knurled knobs to show acceptable limits, or range, and are of visual assistance where a large



Elastomer hardness tester with tolerance hands



Within the first day of startup, full width nylon tire cord processed in this 30-yard-per-minute, 14,000-pound-tension IOI Rollevator® Oven*, was made into aircraft tires meeting all qualification tests.

The Rollevator® roll automatically moves up and down within the oven, in direct relation to line speeds. Thus, at any line speed, heat-exposure time of the nylon is held constant at a constant temperature setting and at constant tension.

Rollevator® Oven* hot stretches nylon tire cord at constant optimum temperature, constant time and constant tension, at variable line speeds

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and the time and expense involved in reheating the oven when starting up again. Its low operating cost combined with low initial cost assures you of lower production cost. An IOI sales engineer will be glad to give you complete information about the Rollevator® Oven* and to discuss your requirements for any system from 3 to 100 yards per minute.

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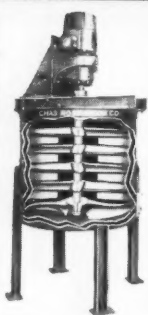
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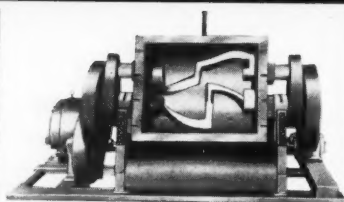


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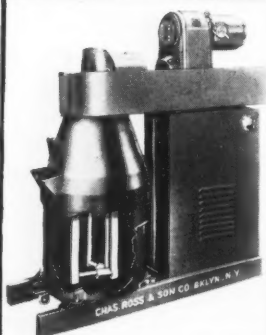
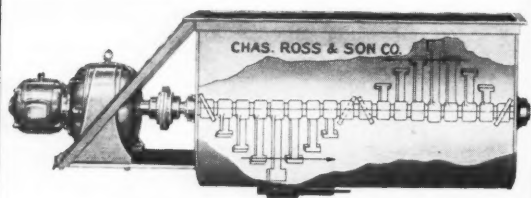


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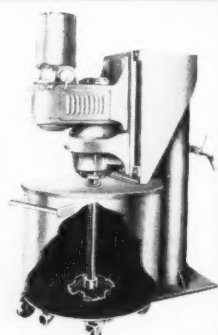


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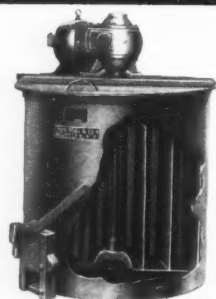
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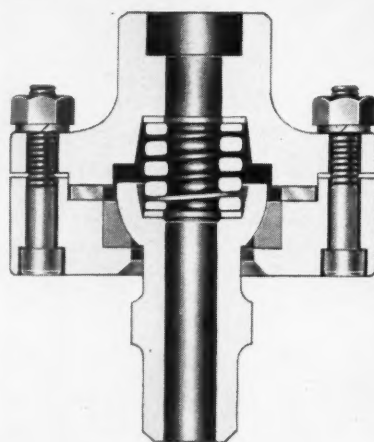
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New Equipment

number of parts in a specific hardness range is to be tested. The instrument is supplied in a mahogany case measuring six by 4½ by 1½ inches. It is available in round-style dial case.

Shore's various durometers are described and illustrated in a booklet, Bulletin R-12, which is available from the company.



New Barco Series 750 swivel joint

Type S Swivel Joints

Barco Mfg. Co., Barrington, Ill., has introduced a New Series 750 Type S swivel joint for steam pressures to 750 psi. and temperatures to 750° F. with new 11CAS gasket. The joints are used to provide pivot points in pipe hook-ups to make the piping movable or flexible. Sizes one inch and 1¼ inches, with screwed or welding ends, are available from stock. Other sizes may be made to order.

To provide strength for the higher pressures, casing and retainer flange are steel, ball is hardened steel, and the spring is stainless steel. Typical applications are on high-temperature steam piping connected to moving machine or equipment parts in power and process industries. One interesting use is for steam connections to multiple-platen hardboard presses.

The special 11CAS gasket is made of specialty treated high-density carbon with a relatively low coefficient of friction and is lapped to the ball. Movement between ball and gasket provides a constant relapping which automatically adjusts for wear. The gasket is installed under compression in the retaining flange to prevent leakage. Barco Series 750 Type S swivel joints may also be supplied with other gaskets for specialized high-temperature and pressure applications.

New NPT Neutral Valve

A lever-operated, ½-inch NPT, 1,000-psi., four-way neutral valve, especially designed for use with raw cold water, oil or glycol-base fluids has been announced by Sinclair-Collins Valve Co., Akron, O. Widely used for controlling press loading lift tables, and in similar applications where tight sealing and leak-free operation are required, the valves are available both in three- and four-way types. All ports are closed in the neutral position.

Bubble-tight sealing is assured by hand-lapped metal-to-metal seats, according to the manufacturer. Valve body is Navy M bronze; seats and stems are stainless steel, and centering springs are Inconel. Molded Hycar packers provide tight sealing and excellent resistance to wear. Packers are said to be readily accessible for servicing, when required. Three 7/16-inch moun-

(Continued on page 157)

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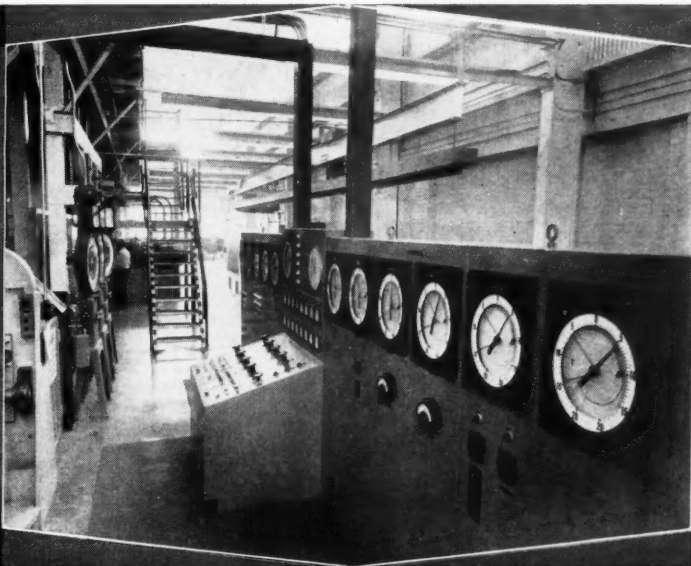
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NEW

MATERIALS

Urethane Foam Additives

Available to makers of flexible polyurethane foams is a new silicone additive, EF-4527, for cell structure control, from Dow Corning Corp., Midland, Mich. This new material may easily be dispersed into a wide variety of commonly used catalysts. Previous additives had to be dispersed in the prepolymer itself, requiring vigorous and sustained agitation to assure uniformity.

Final foams incorporating EF-4527 are identical in every respect to those made with conventional silicone additives: they have a smaller, more even cell structure, uniform resilience and flexibility, and greatly improved appearance.

An oil-in-water 50% emulsion of silicone fluid, Dow Corning EF-4527 is compatible with most catalysts and will remain uniformly dispersed for as long as two weeks. Only one part per hundred parts of prepolymer is required for most flexible foams.

Also available is Dow Corning 200 fluid, the silicone fluid used in EF-4527. It can be added directly to the prepolymer in the amount needed.

Some typical properties of the silicone additives follow:

	Dow Corning EF-4527 Emulsion	Dow Corning 200 Fluid 50 Centistokes
Color.....	milk white	clear
Silicone content, %.....	50	100
Specific gravity at 25° C.....	0.98	0.96
Dispersing medium.....	water	—

A bulletin, P-3-200, is available which describes the use of the two silicone additives as well as typical foam formulations.

Four New Odor-Controllers

Rhodia, Inc., New York, N. Y., has developed four new Alamask odor-control chemicals to be used in latex rubber formulations for molded and dipped goods. The new Alamasks were created to withstand high-temperature processing and abate odorous formulation chemicals, while imparting a pleasant, distinctive fragrance to the product. These products are as follows.

	Alamask BRR (RLT 326)	Alamask BRN (RLT 327)	Alamask BRG (RLT 325)	Alamask BRV (RLT 329)
Odor type.....	rose	neroli	gardenia	violet
Refractive index nd 20.....	1.5130	1.4927	1.5061	1.4975
Specific gravity (25° C).....	0.977	0.934	1.001	0.368
Color.....	medium- dark yellow	dark yellow	dark yellow	medium yellow
Appearance.....	clear	clear	clear	clear
Flash point.....	234° F.	167° F.	215° F.	219° F.

These products, when used at 0.25-1.0% on the batch weight serve to mask out malodors traceable to natural rubber-SBR blends and at the same time to impart a pleasing odor which is distinctive. The products can be applied as either oil or water dispersions.

The above properties are representative of the four products, but should not be considered as purchase specifications.

Tonox-PL Curing Agent

A curing agent for epoxy resins that raises heat distortion points and gives good electrical and chemical properties is being produced by the Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. The chemical is Tonox-PL, p,p'-diaminodiphenylmethane, a solid that can be converted to a liquid by heating to 80° C., and it will stay liquid for several days if held at temperatures between 35 and 40° C.

Tests show that the chemical is a true cross-linking or curing agent, rather than a catalyst, when used with epoxy plastic resins. It contains about 70% of the above chemical, and the balance is a mixture of polymeric materials which are also active curing agents.

In laboratory trials, parts molded from epoxy cured by Tonox-PL have heat distortion points ranging up to 150° C. Electrical properties of the molded parts have been good even under moist conditions. Chemical resistance and physical properties have also been high.

The same chemical (sometimes known as methylene dianiline) has been used for almost 20 years to improve properties of vulcanized rubber products. Some typical physical properties of Tonox-PL follow.

Form.....	brown solid
Specific gravity.....	1.15
Melting point.....	above 80° C.
Storage stability.....	good
Solubility.....	
Ethanol.....	soluble
Acetone.....	soluble
Benzenes.....	soluble
Ethylene dichloride.....	soluble
Gasoline.....	insoluble
Water.....	insoluble
Handling precautions.....	Heating to temperatures above 100° C. and curing operations should be carried out in well-ventilated area.

Further information is available from the company.

Pliovic VO Resin

Pliovic VO, a new polyvinyl chloride dispersion resin developed for plastisol and organosol applications, has been introduced by the chemical division of The Goodyear Tire & Rubber Co., Akron, O. The resin is said to have exceptional electrical properties and viscosity stability characteristics. Wide flexibility in choice of compounding ingredients also is made possible through low initial viscosity and good shelf life.

The new resin contains only minor fractions of non-polymer. It is not a spray dried product. Pliovic VO electrical compounds yield insulative values heretofore available only from Underwriters Laboratories interchangeable resins such as Pliovic EDB90V.

Pliovic VO is reported to have low water absorption. Compounds immersed in 158° F. water for 20 hours showed a 1% gain in weight compared to the 5% to 12% gain normally associated with fused plastisols. Low water absorption contributes to permanence of properties by reducing the extraction of plasticizers where water contact with the finished item is involved.

In addition to such electrical applications as wire coating, cable covering and potting compounds, the new resin is expected to find extensive use in rotational molding operations. Pliovic VO for roto-casting furnishes the fluidity necessary for complete and uniform compound distribution and also assures a dry, non-greasy surface texture. Other uses for the new resin include decorative and protective metal coatings and hot and cold dip compounds.

Some typical physical properties of Pliovic VO follow:

Composition.....	100% PVC
Inherent viscosity.....	1.2
Average particle size.....	1-2 microns
Bulk density.....	25 lbs./ft. ³

A technical data sheet on Pliovic VO is available from the company.

For top quality in urethane foam, specify DB Oil, the castor oil especially designed by Baker for urethane polymers. In the comparative semi-rigid foams, illustrated below, employing Baker's three available grades of castor oil, the foam based on DB Oil gave a minimum shrinkage. These physical tests confirm the visual differences:-

	DB®	AA®	#3
Prepolymer viscosity, cps @ 25°C	7,900	8,515	12,520
Foam density, lb/c.f.	2.3	2.5	4.4
Compression modulus, psi	21	22	18.5
Shrinkage, %	9	19	29

DB Oil, already well established in commercial urethane formulations, combines superior performance with the cost advantage of castor oil. As modifiers for urethane polymers, DB Oil and other castor polyols are gaining ever wider acceptance. For the complete story on over 20 castor polyols suitable for urethanes, write for our Technical Bulletin No. 31.



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New Materials

Boltathene Plastic

Boltathene, a new high-density, low-cost polyethylene material that can withstand temperatures up to 240° F., has been introduced by The General Tire & Rubber Co.'s Bolta Products division, Lawrence, Kan. Having potential uses in many diversified fields, Boltathene is available in sheets up to 70 inches wide and in thicknesses from six gage to 70 gage. Fabrication costs are nominal inasmuch as the material is readily adaptable to low-cost molds.

Unlike conventional low-density polyethylene, the new Boltathene high-density material withstands temperature extremes without change. It does not lose its shape when placed in contact with boiling water, a fact that makes it suitable as a container for hot liquids. It will not crack, shatter, or become brittle at low temperatures, making it ideally suited to such fields as packaging frozen foods inasmuch as food could be sterilized right in a Boltathene container and then placed into deep-freeze storage.

The properties of heat and cold resistance also give Boltathene potential usage in various items for hospitals, infant care, and similar applications where sterilization is required. Its rigidity and high impact strength coupled with its resistance to acids and alkalis make it suitable for such uses as liners for milk tanks, ice cream containers, pharmaceutical packaging, household utensils, etc.

For industrial applications, it could be used for panels, signs, machine parts and housings, utility boxes, battery cases, highway markers, and innumerable other applications.

Some typical physical properties of Boltathene follow:

Melt index.....	0.2-0.5
Density.....	0.96 gms./cc.

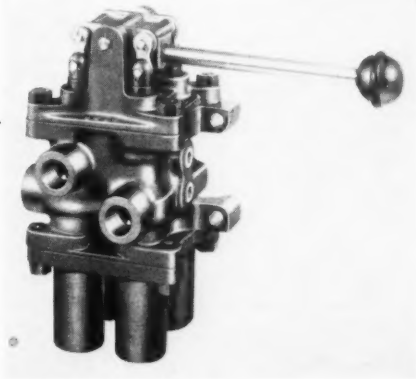
Impact strength (Izod notched).....	3-5 ft. lbs./in.
Tensile strength.....	3500-4200 psi.
Elongation.....	40-200%
Brittleness temperature.....	-106 to -108° F.
Flammability.....	0.8-1.1 in./min.
Hardness Shore D.....	60-70
Heat distortion temperature, 264 psi.....	120° F.
66 psi.....	170° F.
Thickness range.....	0.006- to 0.070-inch

Neutral Valve

(Continued from page 154)

ting holes are provided.

For further information and descriptive literature, write direct to the company.



1/2-inch NPT valve

NEW

PRODUCTS

Style GH-400 Fire Hose

A new fire hose, designated Style GH-400 single jacket, designed primarily for use by the petroleum and chemical industries, has been introduced by the Goodyear Tire & Rubber Co., Akron, O. The construction consists of a seamless, non-porous, age- and oil-resistant neoprene tube; a circular woven jacket of Dacron filler, cotton warp; and a calendered neoprene cover for resistance to oil, sun, aging, and abrasion. Light in weight and flexible, the new hose has a guaranteed test pressure of 400 pounds.

The hose is designed for heavy-duty, high-pressure fire protection, washdown service or sump discharge in refineries, oil transport vessels, mines, mills, and factories. The hose comes in 1½-inch, two-inch, and 2½-inch size, inner diameter. A brass pin lug, rocker lug or rocker lug-type expansion ring coupling is furnished.

A technical bulletin, S-51132, describing the hose is available from the company.

Steelcord Truck Tires

Initial deliveries of this country's first general-purpose Steelcord truck tire have been made to Firestone dealers and stores throughout the country. The tire is being shipped to retail outlets following a recent announcement. The Firestone Tire & Rubber Co., Akron, O., has been producing special-purpose Steelcord tires for several years.

The new lightweight Steelcord has been perfected for highway truck and bus service. It is no longer a special tire for high load capacity vehicles. Normal pressure is used in this new truck tire, making it possible to introduce it in truck fleets using conventional fabric tires. No special air pressure schedules are needed.

The new tire is made of tough steel cord instead of conventional fabric. A single cord of steel can support 385 pounds, compared to 28 pounds for either rayon or nylon. Diameter of a steel cord is 0.048-inch.

The new tire is a major step in development of a full line of steel cord tires. Steelcord construction eliminates growth and dissipates heat and also reduces road delays caused by impact breaks. The combined features add up to more original mileage and higher retread potential.

Lawn Hose by Goodrich

A lawn and garden hose that combines the lightness of plastic and the toughness of natural rubber has been announced by B. F. Goodrich Industrial Products Co., Akron, O. The new hose is appropriately named "Golf Course Hose for Home Use" because, like regular golf course hose, it is built to take the baking action of the sun and the rough treatment of outdoor life.

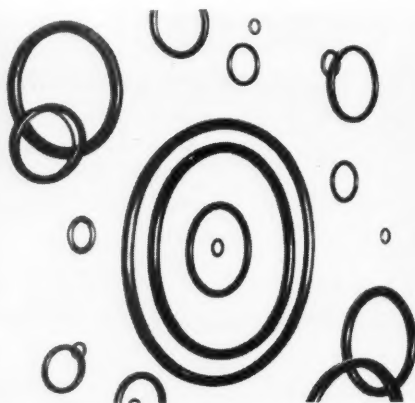
Made with a special compound of man-made rubber, the hose has an inner liner of high-grade synthetic rubber that won't absorb water, cause of rotting in ordinary hose it is claimed. The cover is made of butyl rubber, which resists suncheck and cracking, according to Goodrich. Soft and pliable, the cover prevents stiffness even in cold weather. The hose withstands up to 500 pounds pressure.

Airlex Plastic Insole

A breathable plastic shoe insoling material that is soft, flexible, will not crack, and promises to outwear leather has been announced by Latex Fiber Industries, Inc., a subsidiary of United States Rubber Co. Called Airlex, the new material is made from a cellular plastic through which air can flow. It is bonded to a neoprene-impregnated cellulose fiber sheet. The sheet is absorbent and constructed so that it can be adhered to stuck-on-ribs in Goodyear welts, or to cement or staple lasted uppers in other types of shoe construction.

The plastic insoling, suitable for men's or women's shoes, is said to provide a cool, resilient, pleasant feeling surface for the foot. In addition to being long-wearing and crack-proof, tests have demonstrated the material will not curl even after repeated wettings.

Production runs are expected to start soon, using the joint facilities of the rubber company and Latex Fiber Industries, Inc., Beaver Falls, N. Y. The new material will be distributed by Latex Fiber, and samples in four to five iron thicknesses are expected to be available shortly.



O-Rings molded from SR 251-70

New Stillman O-Rings

O-rings suitable for high-temperature applications, precision-molded from SR 251-70, copolymer formulation, are available from Stillman Rubber Co.

For general dynamic or static sealing applications with synthetic engine oils and hot fuels, recommended high temperature is 450° F., but in some applications the compound is serviceable up to 500° F., depending upon the duration of heating. Normal recommended low-temperature limit is -40° F. The O-rings are available in all standard sizes for special requirements.

Additional information may be obtained from G. W. Van Cleve, vice president-sales, Stillman Rubber Co., 5811 Marilyn Ave., Culver City, Calif.

Acme Steam Hose

A complete line of wire-braid reinforced, burstproof steam hose for saturated steam service at pressures up to 200 psi. or for superheated steam up to 385° F. is now available from Acme Rubber Mfg. Co., Division of Acme-Hamilton Mfg. Corp., Trenton, N. J. Known as Acme W. B. steam hose, it has wide application in all industries for high-pressure steam service, auxiliary fire fighting, and for syphoning or drilling machines. It is also used for flexible steam connection of two lines or for supplemental steam supply.

Reinforced construction prevents explosive rupture in case of hose failure, adding to plant safety by preventing accidental burns. A neoprene cover provides maximum resistance to heat, abrasion, and petroleum products.

Acme W. B. steam hose is built around a tube compounded of special heat-resisting rubber for longer life under high-tempera-

(Continued on page 163)

TECHNICAL

BOOKS

BOOK REVIEWS

"Free Radicals in Solution." By Cheves Walling. Cloth covers, 6 1/8 by 9 1/4 inches, 643 pages. John Wiley & Sons, Inc., New York, N. Y. Price \$14.50.

The chief virtue of this book is that it compiles, in one volume, much of the literature concerned with the chemistry of free radicals in solution. The survey of the literature through June, 1956, appears quite adequate. The book is well organized, clearly written, and carefully edited.

Extensive use is made of vinyl polymerization to illustrate the kinetics of radical chain processes and the relation between structure and reactivity in radical reactions. Other radical chain processes such as additions to double bonds, halogen substitutions, and autoxidation are also adequately discussed. A more sketchy treatment of non-chain processes in which radicals are produced is included.

The skillful use of thermodynamics and kinetics serve to simplify the explanation of many of the results rather than to confuse the issue as is often the case. Graduate work in mathematics or thermodynamics is not required to appreciate the contents of this book.

Certain sections will appear sketchy to specialists, but the adequate literature references make this book almost indispensable to both chemists and physicists, particularly those working in the field of polymers.

Unfortunately, the high cost of this book probably means it will be restricted to the shelves of libraries, and not too many copies will be found on the desks of scientists. It is sincerely hoped that some day an experiment can be carried out to determine if a lower price will result in a sufficient increase in sales that an adequate profit can still be realized.

Regardless, it is recommended that scientists interested in free radical processes examine this book carefully with the ultimate aim of adding it to their personal library. I believe most will agree it will be a worthwhile addition, even at this price.

V. L. FOLT

"Source Book of Industrial Solvents. Volume 2: Halogenated Hydrocarbons." By Ibert Mellan. Cloth cover, 6 1/16 x 9 5/16 inches. 272 pages. Reinhold Publishing Corp., New York, N. Y. Price, \$7.00.

This is Volume 2 in a series of four volumes covering important groups of industrial solvents. Unfortunately the first volume of this series was published under the title, "Handbook of Solvents" thereby generally confusing researchers, librarians, and book reviewers.

This second volume is devoted to halogens, fluorinated hydrocarbons, chlorinated hydrocarbons, brominated hydrocarbons, and iodinated hydrocarbons. A short historical introduction and brief descriptions of important syntheses are given for each class of chemical species discussed. Commercial and proprietary, as well as the ordinary chemical names (not necessarily IUC¹ nomenclature) are used; and a wide range of physical properties is presented for each chemical compound listed.

An interesting observation noted in the introductory chapter was that there are actually five halogens in the periodic table; the newcomer is astatine (atomic number, 85; atomic weight, 211). It is produced, we are told, by β -disintegration of radium A and thorium A.

¹International Union of Pure & Applied Chemistry, National Research Council, Washington, D. C.

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NEW PUBLICATIONS

"Chlorinated P-Xylene Compounds." Diamond Alkali Co., Cleveland, O. This series of informative data sheets of six chlorinated p-xylene derivatives recently developed by the company presents information covering physical properties and chemical reactions of a-chloro-p-xylene; a,a'-dichloro-p-xylene; a,a'-hexachloro-p-xylene; 2-chloro-p-xylene; 2,5-dichloro-p-xylene, and 2,3,5,6-tetrachloro-p-xylene.

"Naugatuck Plastics—Condensed Catalog 1957-58 Resin Guide." United States Rubber Co., Naugatuck Chemical Division, Naugatuck, Conn. 8 pages. Application and physical property data on all plastics produced by the division are given. Included are details on seven types of Kralastic, a resin-rubber blend; seven types of Vibrin polyester resin; and 12 types of Marvinol vinyl resins.

"Influence of Petroleum Oils on Staining and Discoloration of Elastomeric Compounds." G. B. Report No. 10. Golden Bear Oil Co., Los Angeles, Calif. 26 pages. The findings in this report are the result of a comparative study carried out by The Gates Rubber Co. and Golden Bear Oil Co.; The two principal objectives of the investigation were (1) selection of suitable instruments and test methods giving color readings of general validity and permanent meaning, and (2) establishing the influence of oil composition on color phenomena of elastomeric compounds containing the oils. The data reported can serve as a first orientation on how to select petroleum oils suitable as plasticizers and extenders for non-discoloring and non-staining elastomeric compounds.

Publications of The Goodyear Tire & Rubber Co., chemical division, Akron, O., (Tech-Book Facts):

"Pliolite Latex 170—Wax Paper Coatings." 57-319-A. 4 pages. This data sheet gives a suggested paper coating formulation, test data, and conclusions in using Pliolite Latex 170, a high styrene resin emulsion, with a wax for a paper coating.

"Plioflex Rubber—Types and Properties." 57-322. 4 pages. This data sheet presents general information, the typical properties of the raw elastomers, and the properties of the test vulcanizates of various Plioflex SBR copolymers. Copolymers considered are Plioflex 1006, 1500, 1502, 1703, 1710, 1712, 1773, and 1778.

"Recommendation for Meeting Specification AMS 3215-F." 57-361. 2 pages. This sheet offers the formulation for a Chemigum N7 compound which meets the specifications for compounds used in gaskets, diaphragms, bushings, grommets, and sleeves requiring resistance to aromatic and non-aromatic fuels.

"Compound Recommendations for Specifications AMS 3228-C." 57-364. 2 pages. This sheet gives formulations of Chemigum N6B and Chemigum N7 which meet the specifications for compounds used to fabricate hose, packings, grommets, and seals requiring resistance to hot oils and coolant.

"Recommendations for Meeting Specification Chrysler MS-BZ65." 57-324. 2 pages. This sheet includes the formulation of a Chemigum N3-Chemigum N6 compound which meets the specification which covers the properties of compounds used to make oil-resistant valve stem protectors.

"Compounding Neoprene with Pliolite S-6B." 57-46. 8 pages. This data sheet presents a study where neoprene is compounded with Pliolite S-6B and results in improved milling and handling characteristics and acts as a modifier for increasing hardness and stiffness in cured compounds. Complete plots and tables appear.

"Compounding Study: Acceleration of Pliolite S-6B Reinforced Plioflex Compound." 57-182. In this study several commonly used accelerators and accelerator combinations were evaluated for comparative effectiveness on rate and state of cure of a clay-loaded Pliolite S6B-reinforced Plioflex 1703 compound. The compound selected was slow curing and readily demonstrated differences in rate of cure with the various acceleration systems evaluated.

"Rubber Chemicals Suppliers." 57-266. 6 pages. This lists the compounding materials used in the company's guide formulations. It includes the material, specific gravity, the supplier, and address.

"Passenger-Car Tires—Care and Service." The Rubber Manufacturers Association, Inc., New York, N. Y. 24 pages. More than 200,000 copies of this booklet have been purchased by manufacturers and mass distributors of tires for distribution to their retail outlets to acquaint them with the results of abuse and misuse of automobile tires. Interested tire dealers can obtain single copies without charge from the Association, but quantity requirements should be sought from tire manufacturers or mass distributors.

"Monile." The Master Mechanics Co., Cleveland, O. 8 pages. Test data indicating that Monile, the new monolithic floor surfacing material, has a tenacity and bonding strength up to 40 times greater than concrete are included in this illustrated booklet. Typical installations, test results, and methods for application are described.

"Jones Tachometers." Jones Motrola Corp., Stamford, Conn. 12 pages. Included in this booklet is a feature of special interest to engineers—a series of line drawings with dimensions showing various ways in which the company's tachometers may be installed in various applications. Included are ideas that show the possibilities for applications which might help in obtaining better production control, greater quality control, more economical operation, or safer operation.

Publications of the Kenrich Corp., Maspeth, N. Y.:

"Kenmix-Carbon Black Dispersions." 4 pages. This technical bulletin gives the physical and compounding properties of a 25% carbon black—75% Kenflex dispersion for polyethylene and vinyls. A price list is included.

"About Kenmix Dispersions." 8 pages. This bulletin gives general data and price information on Kenflex A, Kenflex N, Kenmix red lead, Kenmix litharge, Kenmix CM litharge, Kenmix carbon black, and other Kenmix accelerator dispersions.

Publications of J. M. Huber Corp., New York, N. Y.:

"Huber Rubber Products Manual Revised Contents Page." 2 pages. This sheet is a revision of the contents page for the company's products manual. It lists carbon blacks, clays, rubber chemicals, and technical reports.

"Butac." One page. This sheet gives the chemical composition, source, physical and compounding properties of Butac, a modified resin acid to be used as a plasticizer and tackifier for SBR.

"Akton." One page. This sheet covers the chemical composition, source, physical and compounding properties of Akton, a modified urea compound to be used as an activator for thiazole and thiuram accelerators.

"Acceleration-Activation of Non-Black Butyl Compounds." Butyl Compounding Study No. 3. 6 pages. This technical report shows the results of a study covering the following phases: comparison of accelerator systems in a mineral-filled butyl compound; combinations of methyl tuads and ethyl tuads with various thiazoles; ratios of ethyl tuads and MBT or MBTS; and comparison of various organic modifiers. Complete data and conclusions are included.

Publications of the Dow Chemical Co., Midland, Mich.:

"Styrene Oxide." 16 pages. This technical bulletin gives the physical properties and specification, preparation, reactions, uses, graphical data, and references of styrene oxide, an aromatic epoxy compound possessing a sharp characteristic odor. The presence of the benzene ring in the compound makes it most useful in the aralkyl-type-intermediates field. Aralkyl alcohols, polyglycols, ketones, aldehydes, acids, and esters are but a few of the many possibilities. Styrene oxide has been used or suggested for the preparation of resins, surface active agents, plasticizers, pharmaceutical intermediates, and other chemical processing intermediates.

"Research Chemicals from Dow." Code No. 164-68. 39 pages. This booklet contains a list of research chemicals currently available in limited quantities from the company. A wide variety of materials is included, ranging from simple inorganic products to complex heterocyclic compounds. Listed for each compound are the name, structural formula, description, some property data, and the sample size available. Prices and specifications are not yet available.

Technical Books

"Richardson PCR Control." Product Data Sheet 5705. Richardson Scale Co., Clifton, N. J. 2 pages. This data sheet describes the company's new PCR Control (Punched Card Reader) for automatic control of blending, batching, and proportioning operations. Illustrated with four photographs and cutaway installation drawing, this two-color data sheet offers full details of how formula changeovers are made. PCR Control is designed for use with electronic proportioning systems, and the data sheet outlines the unit's use with IBM or other punched cards.

"Evaluation of Heat Reactive-Type Dimethylol Phenol Resins as Vulcanizing Agents for Butyl Rubber." Thiokol Chemical Corp., Trenton, N. J. Bulletin 100-4B. 4 pages. Amberol ST-137, CKR-1282, CKR-1634, CKR-5360, Resin 9273, SP-1045, Super Beckacite 1001 and 1003, and AO-14 resins were compounded in the same-type base formula using both an elastomeric type catalyst (Hypalon S-20), and a hydrated metallic chloride (stannous chloride) as the catalyst. The results are discussed and the physical properties of the vulcanizates are presented in tabular form.

"Pyrometer Supplies—Thermocouple Assemblies and Components." Buyer's Guide Catalog G100-8. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. 56 pages. This buyers' guide describes the company's thermocouple accessories for measuring temperatures. This issue covers new Meg-O-Pak assemblies and new insulated extension wire. Included are base-metal thermocouples, small mass, sensitive thermocouples, noble-metal thermocouples, special-purpose thermocouples, mounting attachments, thermocouple components, and charts, inks, and quantity discount schedules.

"Part 6. Rubber, Plastics, Electrical Insulation." American Society for Testing Materials, Philadelphia, Pa. \$4.00. 423 pages. This 1957 supplement to book of ASTM standards includes 70 standards covering rubber products (chemical, physical, aging, and low-temperature tests); automotive and aeronautical rubber; packing and gasket materials; hose; insulated wire and cable carbon black; electronic materials; plastics specifications; strength; hardness, thermal, optical, and permanence properties; analytical methods, molds and molding processes, definitions and nomenclature.

"Hydrous Alumina Silicates." Bulletin 1257. Summit Mining Corp., Carlisle, Pa. 8 pages. This booklet describes the company's selectively mined and specially refined hydrous alumina silicates. It summarizes their chemical properties, compatibilities, physical properties, dehydration reactions, and particle-size distribution and gives a detailed description of each product. A selection chart shows if Microcite, Ser-x, and Ser-a-sil can be used as fillers in a variety of applications including plastics and rubber compounding.

"Model 501-G Pellet Ace." Bulletin 182-A. Sprout, Waldron & Co., Inc., Muncy, Pa. 4 pages. This revised bulletin employs engineering drawings and cutaway photos to illustrate how the design of this industrial pelleting mill assures maximum efficiency. A list of typical products pelleted is included along with the design, engineering, and application data.

"Production of Gamma Radiation with a Linear Electron Accelerator." Applied Radiation Corp., Walnut Creek, Calif. 15 pages. This technical report, describing the generation of gamma rays (Bremsstrahlung) for radiation chemistry research and commercial radiation processing, will prove useful in planning radiation research programs and laboratories, in designing commercial irradiation installations, and in investigating the technical and economic feasibility of high energy radiation processing itself. The report discusses high energy linear accelerators as sources of penetrating gamma radiation and also considers protective shielding. Data are thoroughly documented.

Maggie's DCI-sion:

April is the month of showers and occasional warm days which should remind the wise rubber man that summer heat is near. If you had trouble during last year's torrid weather with your Neoprene compounds —now is the time to try DCI Light Magnesium Oxide to be ready for a trouble-free summer. Write us for samples—test and you'll know.



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Technical Books

Publications of the British Rubber Producers' Research Association; Welwyn Garden City, Herts, England:

No. 255. "Polymerization of Methyl Methacrylate in Polyisoprene Solutions." P. W. Allen and F. M. Merrett. 12 pages. The polymerization of methyl methacrylate in solutions of rubber, gutta percha, and chicle gutta results in a product which can be separated by fractional extraction and precipitation into free polyisoprene, free polymethyl methacrylate, and a compound of the two polymers. The molecular weight of the polymethyl methacrylate component in this compound is about the same as that of the free polymer. Experimental results, tables, a discussion, and references are presented.

No. 256. "Ozonolytic Degradation of Interpolymers of Natural Rubber with Methyl Methacrylate and Styrene." D. Barnard. 8 pages. A simple ozonolytic method has been developed which enables the natural rubber trunk chains of rubber-polymethyl methacrylate and rubber-polystyrene interpolymers to be degraded into low molecular weight fragments from which the liberated polymer may be easily separated for characterization purposes. A dialkyl sulfide is used as a protective agent to prevent the attack of ozone on the polymer and the marked drop in molecular weight which would otherwise result.

No. 257. "The Use of $[C^{14}]$ -Labeled Initiators in Determining the Termination Reaction in Methyl Methacrylate Free-Radical Polymerization: The Importance of Molecular Weight Measurements." P. W. Allen, G. Ayrey, F. M. Merrett, C. G. Moore. 8 pages. This report presents the procedure and the results of an investigation of the mode of termination of polymer radicals in vinyl polymerizations by the use of $[C^{14}]$ -labeled initiator. Plots, a table and references are included.

No. 258. "Carbon-Black Loaded Rubber Vulcanizates: Volume Changes in Stretching." L. Mullins and N. R. Tobin. 14 pages. The changes in volume which occur during the stretching of carbon black reinforced vulcanizates have been measured, and the results used to examine crystallization which accompanies the extension of natural rubber. The effect of previous extension on these changes is interpreted in terms of a simple model previously advanced by the authors to describe the stress-strain properties of reinforced vulcanizates. An introduction, the experimentation, the results, plots, a discussion, and references are presented.

No. 259. "An Extensometer Microscope Stage for Photoelastic Studies in Rubber." E. H. Andrews. 8 pages. This paper describes the instrument and techniques which have made it possible to solve, to a good degree of completeness, the stress distribution around a tear tip in a rubber sheet. The methods employed should be of a general application to materials in which deformability and non-linear stress birefringence exclude the usual stress-optical approach. Diagrams, plots, the procedure, and results are given:

No. 260. "Oxidation of Organic Sulfides. Part VIII." L. Bateman, J. I. Cunneen, J. Ford. 10 pages. Thiacyclohexane, 2-ethyl-2-methyl-5-isopropylthiacyclopentane, and thiacyclohex-3-ene react with oxygen by mechanisms similar to those advanced previously for their respective acyclic analogs. A practical point of difference is that in reactions involving rupture of C-S bonds the products produced in the latter systems are replaced in the former by dimeric products arising from ring openings and subsequent combination of $RS\cdot$ radicals. Experimental methods and results, equations, and references are covered.

Publications released through the Office of Technical Services, U. S. Department of Commerce, Washington, D. C.:

"Dynamic Properties of Solids, Final Report." PB 121701. T. R. Cuykendall and H. S. Sack, Cornell University for the Office of Naval Research. 115 pages. \$3.00. A report of research which was primarily concerned with the determination of the elastic modulus and the internal friction of solids under alternating stresses is given. It is divided into two phases: measurements on metals, mostly single crystals, and measurements on plastics and elastomers, both made over a wide temperature range. Specific plastics and elastomers examined were natural and synthetic rubber, rubber under static stress, isobutylene, polymethylacrylate, Teflon, and cellulose acetate.

"Preparation and Polymerization of Some Fluoroalkyl-methylcyclorosiloxanes." E. C. Stump, Jr., WADC, U. S. Air Force. Order PB 131205. \$0.50. 17 pages. Silicone rubbers have shown promise of withstanding the wide range of temperatures to which elastomeric component parts of new aircraft will be exposed. This study was part of a project to prepare silicone rubbers containing fluorine with the anticipation of increased fuel and oil resistance. Four fluoroalkylmethylchlorosilanes were hydrolyzed, and the resulting cyclorosiloxanes separated and characterized. Gum copolymers with octamethylcyclotetrasiloxane were prepared by conventional methods.

"The Preparation and Polymerization of Perfluoroalkyl Propenyl Ketones." D. A. Rausch, L. E. Coleman, and A. M. Lovelace, WADC, U. S. Air Force. Order PB 131055. \$0.50. 14 pages. A new series of unsaturated ketones containing fluorine was prepared. The monomers were under study for use in the preparation of useful plastic and elastomeric materials for high-temperature applications in military aircraft. Several of the series showed promising copolymer systems. Copolymers of the perfluoroalkyl propenyl ketones with acrylates and methacrylates yielded plastic materials. Ketone-vinyl acetate copolymers also held promise as plastics. Copolymers with dienes were elastomers, and preliminary work indicated increased solvent resistance and low-temperature flexibility.

"Investigation of Condensation Type Elastomers." G. C. Schweiker *et al.*, Hooker Electrochemical Co. for WADC, U. S. Air Force. Order PB 131178. \$1.50. 55 pages. This report describes progress in the development of a rubber for special applications with such properties as thermal stability above 350° F.; resistance to aromatic fuels, synthetic ester-base oils, hydraulic factory performance at -65° F. or lower. An elastomer with this superior balance of properties was sought through a study of fluorine-containing condensation polymers and difunctional starting materials.

"The Irradiation of Polyvinyl Methyl Ether with Electrons and Gamma Rays to Form Elastomers." PB 131003. D. Duffey, Naval Research Laboratory. 35 pages. \$1.00. This report, which includes radiation synthesis procedures, describes research whereby polyvinyl methyl ether and mixtures of the ether with a variety of powdered fillers were irradiated with electrons from a Van de Graaff accelerator and gamma rays from cobalt-60. Elastomers were obtained with properties comparable to those properties of radiation vulcanization of natural and synthetic rubbers. Fillers were necessary to give irradiated products much strength.

"Richardson Model K-14 Weighing or Storage Hopper." Product Data Sheet 5704. Richardson Scale Co., Clifton, N. J. 2 pages. This two-color data sheet describes a dual-purpose hopper for the weighing or storage of fluffy, difficult-to-handle dry materials. Discussed are operating details, capacities, construction features, and methods of charging and discharging. Details of construction and installation also appear.

Steam Hose

(Continued from page 158)

ture live steam. Reinforcement is provided by one or two braided plies of high-tensile steel wire, each covered by a layer of heat-resistant rubber. High-tensile cord yarn covers the outer layer and aids in bonding the neoprene hose cover. Standard sizes include 1/2-, 3/4-, 1-, 1 1/4-, 1 1/2-, 2-, and 2 1/2-inch ID.



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MARKET

REVIEWS

Synthetic Rubber

The combined effect of a short month and the current business slow-down was evident in the production-consumption statistics for synthetic rubber for the month of February, as released by The Rubber Manufacturers Association, Inc., on March 25. Consumption of all types of synthetic rubber dropped to 63,520 long tons, as compared with the January consumption of 72,625 tons. Of the total new rubber consumed in February, however, synthetic rubber accounted for 63.5%, against the 63% in January, in spite of the prevailing low price for natural rubber.

Consumption of synthetic rubber by types in February compared with January use, was as follows: SBR, 52,768 tons, against 60,179; neoprene (CR), 4,741 tons, against 5,928; butyl (IIR), 4,224, against 4,508; and nitrile (NBR), 1,787, against 2,010.

Production by types in February, compared with January output was reported to be: SBR, 66,406 tons against 85,379; CR, 8,200, against 8,804; IIR, 4,996, against 6,149; and NBR, 2,150, against 2,384.

Stocks on hand did not increase greatly because of this adjustment of production to consumption rising only from 210,397 to 213,254 tons for all synthetic rubbers.

Total exports were somewhat lower in February at 15,600 tons, compared to 19,710 tons in January, but for the first two months of 1958, at 35,310 tons, they were ahead of exports in the same period in 1957 when they amounted to 34,015 tons.

There is a feeling in some quarters that synthetic rubber demand may have leveled out, and that March and April consumption, even after taking into account the greater number of working days in these months, will be no lower than the February figure and may show a modest upturn.

Natural Rubber

During the February 16-March 15 period, growing concern over the tense Indonesian situation among London rubber traders led to increased buying

and firmer prices here as well as abroad. Trading volume here improved to the highest that it has been in several months and reflected covering and new commission house buying. Activity broadened to include all 1958 positions; while 1959 deliveries were untraded.

Toward the close of this period rubber futures rose sharply as the Indonesian civil war gained momentum, and first effects of the fighting brought about increased nervousness of shorts. The market appeared to be overcoming resistance points as a result of the Indonesian action. Trade sources reported that one of the first direct effects of the shooting was to bring a rise in insurance rates. At the same time it was said that dealers were becoming reluctant to buy because of uncertainty now of shipments, the prospect of claims on damages, and other reasons.

The Natural Rubber Bureau, Washington, D. C., reported that substantial portions of Malayan jungles could be converted to high-yielding rubber trees. The resulting increases in natural rubber could make it a real competitor for a growing share of the expanding rubber market, according to many economists. It has been frequently noted that price is a major element in establishing the American use ratio of synthetic and natural. Over the past couple of months the prices of those grades of natural rubber which are readily substitutable for general-purpose synthetics have been moving into a competitive range with SBR here. This fact reflected itself in recent usage figures.

February sales, on the New York Commodity Exchange, amounted to 12,220 tons, compared with 10,910 tons for January; none were on the Rubber-Standard Contract. There were 19 trading days in February and 20 during the February 16-March 15 period.

REX CONTRACT

	Feb. 21	Feb. 28	Mar. 7	Mar. 14
1958				
Mar.	26.30	26.40	26.32	26.55
May	26.70	26.00	26.38	26.72
July	26.90	26.60	26.50	26.80
Sept.	26.95	26.63	26.57	26.83
Nov.	27.00	26.63	26.59	26.87
1959				
Jan.	27.05	26.65	26.60	26.95
Mar.	27.05	26.65	26.60	26.95
Total weekly sales, tons	3,570	3,380	3,920	2,780

On the physical market, RSS #1, according to the Rubber Trade Association of New York, averaged 26.37¢ per pound for the February 16-March 15 period. Average February sellers' prices for representative grades were: RSS #3, 24.68¢; #3 Amber Blankets, 23.92¢; and Flat Bark, 20.35¢.

NEW YORK OUTSIDE MARKET

	Feb. 21	Feb. 28	Mar. 7	Mar. 14
RSS #1	26.25	26.38	26.25	26.63
2	25.63	25.25	25.25	25.50
3	24.50	24.50	24.38	24.50
Pale Crepe				
#1 Thick	28.38	28.50	28.50	28.25
Thin	28.38	28.50	28.50	28.25
#3 Amber Blankets	23.88	23.63	23.38	23.38
Thin Brown Crepe	23.25	23.00	22.88	22.88
Standard Bark				
Flat	20.25	20.13	20.00	20.13

Latex

The liquid latex market has generally been quiet, but a little more interest has been shown during the close of the period under review. Some buying for nearby shipment has been reported, and, although on a scattered and very modest scale, it appears to have been sufficient to halt the gradual decline in the differential for the time being. There has also been a little interest in bulk latex for forward shipment.

Consumption in the United States during January amounted to 6,380 tons, compared with 6,006 tons in December. U. S. stocks on January 31 totaled 14,178 tons, compared with 11,831 tons on the same date last year, and 14,299 tons on December 31, 1957.

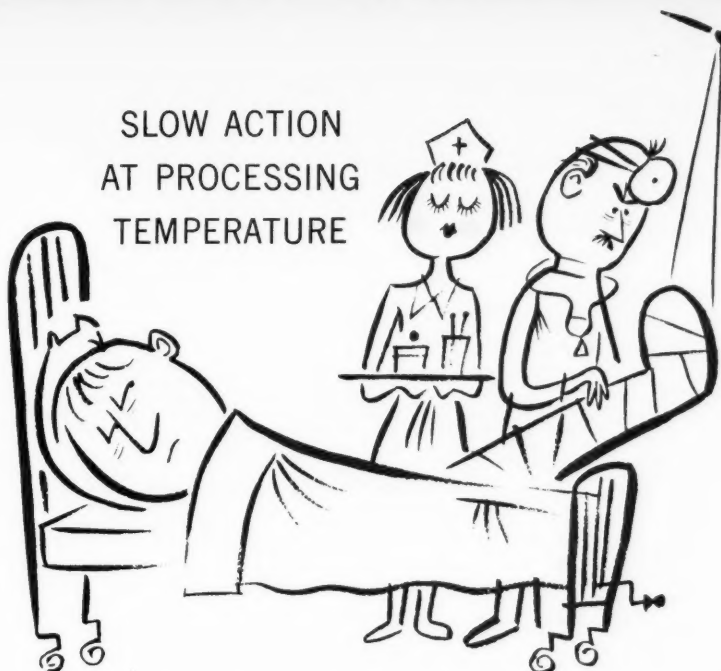
Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b., rail tank car, ran about 32.86¢ per pound solids. Synthetic latices prices were 22.5 to 31.2¢ for SBR; 37 to 55¢ for neoprene; and 46 to 65¢ per pound for nitrile types.

Final December, preliminary year-end total, and preliminary January domestic statistics for all latices were reported by the United States Department of Commerce as given in the tabulation below:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Con-Month-End Stocks
Natural			
Dec.	0	5,933	14,454
Total, '57.	0	69,513	76,509
Jan.	0	6,380	14,178
SBR			
Dec.	5,915	—	5,260
Total, '57.	74,405	—	67,305
Jan.	5,998	—	5,438
Neoprene			
Dec.	704	0	633
Total, '57.	10,403	0	9,039
Jan.	788	0	806
Nitrile			
Dec.	734	0	606
Total, '57.	11,420	0	8,630
Jan.	785	0	683

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SALES REPRESENTATIVES AND WAREHOUSE STOCKS: Akron Chemical Company, Akron, Ohio • H. M. Royal, Inc., Trenton, N. J. • H. M. Royal, Inc., Los Angeles, Calif.
Ernest Jacoby & Company, Inc., Boston, Mass. • Herron & Meyer of Chicago, Chicago, Illinois • In Canada: St. Lawrence Chemical Company, Ltd., Montreal and Toronto

Scrap Rubber

The outlook for the near future for the scrap rubber market is tending to be slightly optimistic. This is mainly due to the anticipated seasonal upturn of consumer purchases of replacement tires during the summer months which would reflect itself in terms of increased consumption on the part of the reclaim industry.

Inventories, during the period under review, were at relatively low levels, and buying is being done on a month-to-month consumption basis.

It was reported that the postponement of the proposed increase in carload freight rates has been helpful to the entire scrap rubber picture.

	Eastern Points	Akron, O.
	Per Net Ton	
Mixed auto tires	\$8.00-\$11.0	\$12.00
S. A. G. truck tires	Nom.	15.50
Peeling, No. 1	Nom.	23.00
2	Nom.	20.00
3	Nom.	15.50
Tire buffings	Nom.	Nom.
	(\$ per Lb.)	
Auto tubes mixed	2.75	2.75
Black	6.25	6.25
Red	6.50	7.00
Butyl	3.50	3.75

Reclaimed Rubber

The reclaimed business was reported for the February 16—March 15 period to have been the slowest in some time, according to one reclaimer. Indications were that March may improve, based on current orders.

According to The Rubber Manufacturers Association, Inc., report, February production of reclaimed rubber reached 21,896 tons; while consumption was 22,773 long tons.

RECLAIMED RUBBER PRICES

Whole tire, first line	\$0.11
Third line	.1025
Inner tube, black	.16
Red	.21
Butyl	.14
Light carcass	.22
Mechanical, light-colored, medium gravity	.155
Black, medium gravity	.085

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity, at special prices.

Industrial Fabrics

Buying of most industrial textiles continues at a very slow pace, reflecting further reductions in auto output in early March and a generally lower level of activity in the machinery, chemical, rubber, and other industries.

Sales of industrial textiles, including

woven and non-woven fabrics for coating, hose and belting ducks, and filtration textiles have consequently remained on an extremely limited basis, with most transactions involving small lots of goods for quick shipments. Users of industrial textiles in the above fields are keeping their inventories at sharply reduced levels, it is reported, in line with the lower level of their own operations.

While little indication is evident for an improvement in demand for automotive fabrics and some of the other heavy industrial goods, it is considered likely that a modest improvement could develop in May and June in buying of coated fabrics by other industries.

Some sales have taken place in the 59-inch, 2.25-yd drill at 28¢ in a number of cases, with less desirable makes selling even lower. The 59-inch, 1.85-yd drill, which has been quoted at 33½¢ for some time, is reported to have sold in some instances at around 32½¢ to 33¢ a yard.

In wide sheetings, similar price concessions can be obtained from some sources of supply.

INDUSTRIAL FABRICS

Drills		
59-inch 1.85 yd.	yd.	\$0.335/.34
2.25-yd.		.285/.29
Ducks		
38-inch 1.78-yd. S.F.	yd.	nom.
2.00-yd. D.F.		.30
51.5-inch, 1.35-yd. S.F.	yd.	
Hose and belting		.63
Osaburgs		
40-inch 2.11-yd.	yd.	.2275
3.65-yd.		.1525
Raincoat Fabrics		
Printcloth, 38½-in., 64-60,		
5.35-yd.	yd.	.1325
6.25-yd.		.1165
Sheeting, 48-inch, 4.17-yd.		.20
52-inch, 3.85-yd.		.2275
Chafar Fabrics		
14.40-oz./sq. yd. Pl.	yd.	.73
11.65-oz./sq. yd. S.		.61
10.80-oz./sq. yd. S.		.6575
8.9-oz./sq. yd. S.		.67
Other Fabrics		
Headlining, 59-in.; 1.65-yd.,		
2-ply	yd.	.41
64-inch, 1.25-yd., 2-ply		.59
Sateens, 58-inch, 1.32-yd.		.52/.525
58-inch, 1.21-yd.		.5675

Rayon

Total packaged production of rayon and acetate filament yarn during January was 57,600,000 pounds, consisting of 28,800,000 pounds of high-tenacity rayon yarn and 28,800,000 pounds of regular-tenacity rayon yarn. For February the total was 49,400,000 pounds, consisting of 22,900,000 pounds of high-tenacity rayon yarn and 26,500,000 pounds of regular-tenacity rayon yarn. December production had been: total, 56,200,000 pounds, including regular-tenacity yarn, 30,600,000 pounds, high-tenacity rayon yarn, 25,600,000.

Filament yarn shipments to domestic consumers for January totaled 58,900,000 pounds, of which 29,100,000 pounds were high-tenacity rayon yarn and 29,800,000 pounds were regular-tenacity rayon yarn. For February, shipments totaled 48,500,000 pounds, of which 20,700,000 pounds were high-tenacity rayon yarn and 27,800,000 pounds were regular tenacity rayon yarn. December shipments had been: total, 53,500,000 pounds; high-tenacity, 25,200,000 pounds; regular-tenacity, 28,300,000 pounds.

Stocks on January 31 totaled 69,900,000 pounds, made up of 15,800,000 pounds of high-tenacity rayon yarn and 54,100,000 pounds of regular-tenacity rayon yarn. End-of-February stocks totaled 69,900,000 pounds, consisting of 17,600,000 pounds of high-tenacity yarn and 52,300,000 pounds of regular-tenacity rayon yarn. End-of-December stocks had been: total, 71,800,000 pounds; high-tenacity rayon yarn, 16,200,000 pounds; regular-tenacity yarn, 55,600,000 pounds.

There were no reported price changes recently.

RAYON PRICES

Tire Fabrics		
1100/490/2		\$0.69 / \$0.73
1650/908/2		.63 / .725
2200/980/2		.625 / .655
Tire Yarns		
High-Tenacity		
1100/ 490, 980		.50/ .64
1100/ 490		.59/ .63
1150/ 490, 980		.59/ .63
1165/ 480		.59/ .65
1230/ 490		.59/ .63
1650/ 720		.55/ .58
1650/ 980		.55/ .58
1875/ 980		.55/ .58
2200/ 960		.54/ .57
2200/ 980		.54/ .57
2200/1466		.64
4400/2934		.60
Super-High Tenacity		
1650/ 720		.58
1900/ 720		.58

"Dacron" in V-Belts

Improved adhesion of "Dacron" polyester fiber to SBR and neoprene V-belt stocks by means of an aqueous dip coded D-15, has been announced by the textile fibers department of E. I. du Pont de Nemours & Co., Inc. D-15 utilizes an aqueous dispersion of a phenol-blocked isocyanate in combination with a suitable latex.

Also announced is an improvement in dimensional stability of "Dacron" obtained by modified cord stretching and curing procedures similar to the techniques used for the stabilization of nylon tire cord.

These advances were described by J. M. Swanson of the Du Pont company before the Textile Research Institute in New York on March 13.

Curiosity
killed the
cat...



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STATISTICS

of the RUBBER INDUSTRY

U.S.A. Imports and Production of Natural (Including Latex and Guayule) and Synthetic Rubber (in Long Tons)

Year	Natural	GR-S	SBR-Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic
1955	637,577	236,556	564,589	56,179	91,357	32,623	1,616,478
1956							
Jan.	58,803	.....	76,028	6,896	8,207	3,125	153,059
Feb.	56,497	.....	73,457	6,229	8,560	2,989	147,732
Mar.	52,749	.....	77,812	5,686	7,822	3,663	147,732
Apr.	51,394	.....	74,502	5,685	8,481	3,648	143,710
May	39,789	.....	78,309	5,647	7,795	2,903	134,443
June	36,694	.....	69,820	4,638	8,929	2,350	122,431
July	41,195	.....	70,831	7,192	7,935	2,460	129,613
Aug.	40,367	.....	70,122	7,118	7,769	2,141	127,517
Sept.	42,974	.....	73,321	7,252	8,328	2,322	134,197
Oct.	52,638	.....	70,690	7,018	8,144	2,973	141,463
Nov.	49,757	.....	66,482	6,065	8,614	3,092	134,010
Dec.	57,653	.....	76,056	6,496	8,828	2,921	151,954
Yr.-end adj.	+1,293	.....	.....	.....	.....	.....	+1,293
Total	579,217	.....	877,430	75,922	99,412	34,567	1,667,841
1957							
Jan.	46,349	.....	76,224	6,366	9,432	2,893	141,264
Feb.	37,487	.....	66,023	5,664	9,004	2,894	121,072
Mar.	40,680	.....	76,546	6,460	8,031	3,291	135,008
Apr.	59,896	.....	65,706	5,890	8,902	2,408	142,802
May	52,566	.....	77,542	6,145	9,235	2,561	148,049
June	30,290	.....	68,297	4,474	9,678	2,538	137,553
July	44,760	.....	67,796	1,972	8,591	2,592	125,711
Aug.	48,951	.....	76,197	5,455	9,033	2,737	142,373
Sept.	47,937	.....	75,872	6,113	9,726	2,826	142,474
Oct.	49,371	.....	87,709	6,085	9,545	3,062	155,772
Nov.	44,583	.....	87,152	6,099	9,976	2,803	148,362
Dec.	.....	.....	85,223	6,469	9,568	2,519	.....
Total*	499,121	.....	907,534	66,936	110,721	33,124	1,617,436
1958							
Jan.*	.....	.....	85,379	6,149	8,804	2,384	.....

*Preliminary. Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

U.S.A. Consumption of Natural (Including Latex) and Synthetic Rubber (Long Tons)

Year	Natural	GR-S	SBR Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic
1955	634,800	234,963	507,034	53,991	72,876	26,035	1,529,699
1956							
Jan.	53,751	.....	65,375	4,223	6,684	2,198	132,231
Feb.	50,285	.....	62,366	4,155	6,430	2,289	125,525
Mar.	50,040	.....	64,458	4,515	6,542	2,373	127,928
Apr.	47,446	.....	62,179	4,228	6,125	2,150	122,128
May	48,342	.....	63,629	4,285	6,379	2,103	124,738
June	43,638	.....	56,390	4,026	5,536	1,864	111,454
July	38,353	.....	48,907	3,316	4,435	1,538	96,549
Aug.	46,700	.....	59,756	4,102	6,554	2,125	119,237
Sept.	44,179	.....	57,135	4,044	6,057	1,969	113,384
Oct.	52,188	.....	67,399	4,780	7,478	2,366	134,211
Nov.	42,946	.....	58,692	4,093	6,676	2,065	114,472
Dec.	45,220	.....	60,742	3,814	5,956	1,893	117,625
Yr.-end adj.	-1,000	.....	-3,000	.....	.....	+1,000	-3,000
Total	562,088	.....	724,028	49,581	74,852	25,933	1,436,482
1957							
Jan.	52,631	.....	70,978	5,028	7,237	2,247	138,121
Feb.	46,427	.....	64,322	4,581	6,235	2,122	123,687
Mar.	48,263	.....	67,853	4,998	6,559	2,240	129,913
Apr.	45,368	.....	63,280	4,651	6,295	2,129	121,723
May	46,385	.....	66,774	4,902	6,441	2,125	126,753
June	41,282	.....	58,479	4,198	5,816	1,963	111,738
July	39,683	.....	58,021	4,146	5,231	1,646	108,833
Aug.	44,846	.....	66,089	4,461	6,502	2,220	124,204
Sept.	43,527	.....	64,505	4,654	6,351	2,141	121,326
Oct.	48,782	.....	73,850	5,343	7,194	2,433	137,602
Nov.	43,816	.....	62,635	4,521	6,136	2,110	119,218
Dec.	38,285	.....	56,432	3,930	5,464	1,811	105,922
Total*	539,761	.....	773,218	55,413	75,461	25,187	1,469,040
1958							
Jan.*	42,597	.....	60,179	4,508	5,928	2,010	115,222

* Preliminary. Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

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FOR SALE: ALL IN STOCK: 5—PFAUDLER 500-GALLON glass-lined Reactors, 1—Patterson-Kelley 30 cu. ft. twin-shell blender, st. st. 6—465-gal. stainless Reactors, 150# W.P., 165# jkt. 3—4' x 84" vert. Vulcanizers, quick-opening doors, ASME 120#, 1—Farrel 500/1500 HP. Horiz. Reducer. PERRY EQUIPMENT CORP., 1424 N. 6th St., Phila. 22, Pa.

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- 1—Banbury Midget Mixer with 2 HP gear motor.
- 1—Farrel Birmingham 3-roll Lab Calender, 6" x 12".

ADDRESS BOX NO. 2151, c/o RUBBER WORLD

U.S.A. Stocks of Latex

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1956	12,262	7,327	1,421	2,217	10,965	23,227
1957						
Jan.	11,831	7,191	1,329	1,936	10,456	22,287
Feb.	9,940	7,415	1,169	2,051	10,635	20,575
Mar.	10,173	7,689	1,170	2,157	11,016	21,189
Apr.	12,064	8,096	1,183	1,836	11,115	23,179
May	11,733	7,885	1,407	1,710	11,002	22,735
June	10,931	8,139	1,377	2,001	11,517	22,448
July	12,073	8,045	1,296	1,953	11,294	23,367
Aug.	13,535	7,997	1,309	1,545	10,851	24,386
Sept.	12,315	7,566	1,141	1,700	10,407	23,722
Oct.	12,399	7,254	1,142	1,723	10,119	22,518
Nov.	12,316	7,558	1,265	1,927	10,750	23,066
Dec.†	14,454	8,347	1,267	1,174	11,588	26,042
1958						
Jan.†	14,178	8,222	1,190	2,052	11,464	25,642

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

* Includes SBR-Types.

† Preliminary.

U.S.A. Automotive Inner Tubes

(Thousands of Units)

Year	Shipments				Production	Inventory End of Period
	Original Equipment	Re-placement	Export	Total		
1956	3,101	32,358	1,041	36,499	34,407	6,109
1957						
Jan.	274	3,263	72	3,608	2,918	6,294
Feb.	267	2,964	61	3,292	3,362	5,960
Mar.	240	3,057	100	3,397	3,822	6,540
Apr.	311	2,708	85	3,104	3,428	6,969
May	301	2,827	86	3,214	3,548	7,422
June	275	3,141	69	3,485	3,025	6,946
July	258	3,364	86	3,708	2,941	6,287
Aug.	243	3,358	81	3,683	3,134	5,966
Sept.	213	3,180	90	3,483	3,365	6,174
Oct.	242	2,809	121	3,172	3,764	6,909
Nov.	259	2,468	65	2,792	2,585	6,250
Dec.	225	2,392	101	2,717	2,778	7,671
Total	3,045	35,684	1,077	39,806	39,763	
1958						
Jan.	232	4,005	71	4,309	3,344	6,699

Source: The Rubber Manufacturers Association, Inc.

U.S.A. Stocks of Synthetic Rubber

(Long Tons)

Year	SBR-Types	Butyl	Neoprene	N-Type	Total
1956	151,934	28,685	14,043	8,184	202,846
1957					
Jan.	143,177	29,810	13,073	7,664	193,724
Feb.	144,587	29,951	12,705	7,565	184,808
Mar.	131,255	30,814	11,949	7,795	181,813
Apr.	122,764	31,536	12,064	7,247	173,611
May	121,638	31,812	13,010	6,981	173,441
June	120,694	31,569	13,822	7,085	173,170
July	113,143	28,208	15,172	7,125	163,648
Aug.	111,962	28,339	14,603	6,784	161,688
Sept.	109,417	29,132	14,751	7,207	160,507
Oct.	113,382	29,008	15,181	7,134	164,705
Nov.	124,432	29,702	16,453	7,380	177,967
Dec.*	141,199	31,489	18,843	7,454	198,985
1958					
Jan.*	152,441	31,753	18,691	7,512	210,397

Source: Bureau of Census, Industry Division, Chemicals Branch, United States Department of Commerce.

* Preliminary.

U.S.A. Consumption of Natural and Synthetic Latexes

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1956	73,100	65,380	8,733	8,934	83,047	156,147
1957						
Jan.	6,994	6,288	856	841	7,985	14,979
Feb.	6,398	5,894	758	708	7,360	13,758
Mar.	7,081	6,370	784	799	7,953	15,034
Apr.	6,434	5,554	772	710	7,036	13,470
May	5,867	5,114	814	731	6,659	12,526
June	5,445	4,790	736	610	6,136	11,681
July	5,180	4,269	677	480	5,426	10,606
Aug.	6,499	5,758	784	823	7,365	13,864
Sept.	6,645	5,676	712	753	7,141	13,786
Oct.	7,250	6,556	788	857	8,201	15,451
Nov.	6,783	5,776	725	712	7,213	13,996
Dec.	5,933	5,260	633	606	6,499	12,432
Total	76,509	67,305	9,039	8,630	84,974	161,483
1958						
Jan.†	6,380	5,438	806	683	6,927	13,307

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

† Preliminary.

* Includes SBR-Types.

U.S.A. Exports of Synthetic Rubber

(Long Tons)

Year	SBR-Types	Butyl	Neoprene	N-Type	Total
1956					
Jan.	7,550	815	1,757	506	10,628
Feb.	9,018	1,624	1,521	449	12,612
Mar.	10,804	764	1,500	522	13,590
Apr.	10,271	374	1,917	587	13,149
May	10,864	743	2,142	443	14,192
June	9,558	746	2,088	548	12,940
July	9,038	523	1,994	433	11,988
Aug.	9,607	654	2,268	274	12,803
Sept.	8,804	439	2,824	403	12,470
Oct.	6,795	454	1,013	618	8,880
Nov.	4,789	247	1,056	551	6,643
Dec.	15,268	1,316	1,829	860	19,273
Total	112,366	8,699	21,909	6,194	149,168
1957					
Jan.	13,989	207	2,500	540	17,236
Feb.	13,353	439	2,505	482	16,779
Mar.	13,664	1,014	2,466	781	17,925
Apr.	10,625	372	2,244	620	13,861
May	12,208	603	2,480	517	15,808
June	13,886	762	2,315	492	17,455
July	14,444	1,169	3,426	631	19,670
Aug.	13,795	758	2,786	478	17,817
Sept.	11,625	540	1,964	396	14,525
Oct.	12,200	1,261	2,588	467	16,516
Nov.	12,639	809	2,521	410	16,379
Dec.	15,549	814	2,447	563	19,373
Total	157,977	8,748	30,242	6,377	203,344

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

U.S.A. Imports and Production of Natural and Synthetic Latexes

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1956	71,718	69,762	10,642	10,650	91,054	162,772
1957						
Jan.	6,460	7,228	905	960	9,093	15,553
Feb.	4,342	6,481	724	1,035	8,240	12,582
Mar.	5,856	7,227	924	1,127	9,278	15,134
Apr.	8,812	6,306	976	881	8,163	16,975
May	5,794	5,495	1,082	933	7,510	13,304
June	4,809	5,251	819	886	6,956	11,765
July	6,243	4,646	572	844	6,062	12,305
Aug.	6,834	6,816	874	608	8,298	15,132
Sept.	5,516	5,649	917	1,285	7,851	15,268
Oct.	8,351	6,876	885	1,133	8,894	14,811
Nov.	6,496	6,515	1,021	994	8,530	15,026
Dec.†	.....	5,915	704	734	7,353	.....
Total†	69,513	74,405	10,403	11,420	96,228	165,741
1958						
Jan.†	.....	5,998	788	785	7,571	.....

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

* Includes SBR-Types.

† Preliminary.

MACHINERY & SUPPLIES FOR SALE (Cont'd)

HYDRAULIC PRESSES, 2500-TON DOWNSTROKE 54" x 102", 375-ton upstroke 28" x 28", 300-ton upstroke 41" x 30", 300-ton upstroke 22" x 35", 300-ton multi-opening 40" x 40" platens, 250-ton French Oil upstroke 38" x 28", 170-ton upstroke 24" x 24", 150-ton Elmes upstroke 36" x 25", 140-ton 36" x 36" platens, 300-ton Stokes Transfer Molding Press, New & Used Lab, 6" x 13", 6" x 16", and 8" x 16" Mills and Calenders, & sizes up to 84". Baker-Perkins & Day Heavy-Duty Jack. Mixers up to 200 gals. Hydraulic Pumps & Accumulators. Rotary Cutters. Colton 5 1/2 T, 4T & 3DT Preform Machines Motor Driven. Other sizes in Single Punch & Rotary Pre-Form Machines. Banbury Mixers, Crushers, Churns, Tubers, Vulcanizers, Bale Cutters, Gas Boilers, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY, 107-8th Street, Brooklyn 15, New York. STerling 8-1944.

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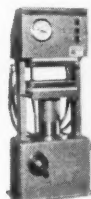


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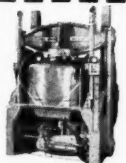
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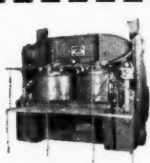
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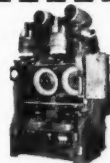
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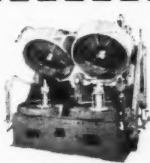
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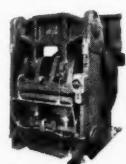
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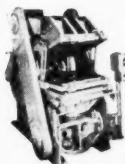
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Carbon Black Statistics—Twelve Months, 1957

Furnace blacks are classified as follows: SRF, Semi-reinforcing furnace black; HMF, high modulus furnace black; FEF, fast-extruding furnace black; HAF, high abrasion furnace black; SAF, super abrasion furnace black; ISAF, intermediate super abrasion furnace black.

(Thousands of Pounds)

Production	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Furnace types													
Thermal	13,200	10,064	12,147	13,533	14,395	11,989	11,680	10,797	10,432	11,814	9,938	11,301	141,290
SRF	26,328	21,623	27,167	24,726	24,216	21,406	21,114	24,298	20,995	23,981	23,684	24,494	284,032
HMF	11,112	10,898	10,292	10,105	11,052	10,563	11,825	10,244	10,674	11,023	10,492	10,939	129,219
FEF	17,125	13,340	20,439	18,621	19,809	17,240	18,174	18,020	19,377	18,474	19,577	20,836	221,032
HAF	42,186	34,730	41,201	35,038	40,048	36,910	34,655	47,879	37,872	39,042	40,596	41,300	471,457
SAF, ISAF	16,348	15,246	18,864	15,213	15,512	16,488	18,747	15,681	17,828	17,129	14,368	13,791	195,215
Total furnace	126,299	105,901	130,110	117,236	125,032	114,596	116,195	126,919	117,178	121,463	118,655	122,661	1,442,245
Contact types	31,563	27,792	30,726	29,879	30,733	29,497	30,556	30,268	28,389	29,278	29,367	30,771	358,819
Totals	157,862	133,693	160,836	147,115	155,765	144,093	146,751	157,187	145,567	150,741	148,022	153,432	1,801,064
Shipments													
Furnace types													
Thermal	13,499	11,726	12,442	12,556	11,488	9,931	10,993	10,930	11,310	13,517	11,624	9,887	139,903
SRF	25,864	24,246	37,063	19,359	21,453	21,771	22,343	21,807	20,908	26,549	23,905	20,680	285,948
HMF	10,517	10,273	13,449	9,584	9,695	10,314	9,999	10,840	11,983	10,900	11,224	10,256	129,034
FEF	21,080	17,685	26,129	14,441	18,918	14,424	17,199	18,334	17,674	20,776	18,155	15,976	220,791
HAF	38,446	37,049	55,187	30,348	40,524	33,826	36,650	40,299	38,196	43,895	42,517	37,492	474,429
SAF, ISAF	15,978	14,692	20,562	15,622	15,505	14,225	15,882	17,529	16,538	17,381	16,191	13,764	193,869
Total furnace	125,384	115,671	164,832	101,910	117,583	104,491	113,066	119,739	116,609	133,018	123,616	108,055	1,443,974
Contact types	35,688	32,565	42,196	28,276	25,916	24,989	26,596	26,898	27,443	31,130	27,835	26,024	355,556
Totals	161,072	148,236	207,028	130,186	143,499	129,480	139,662	146,637	144,052	164,148	151,451	134,079	1,799,530
Producers' Stocks, End of Period													
Furnace types													
Thermal	18,478	16,816	16,521	17,498	20,405	22,463	23,150	23,017	22,139	20,436	18,750	20,164	20,164
SRF	76,472	73,781	63,885	69,252	72,015	71,650	70,421	72,912	72,999	70,431	70,210	74,024	74,024
HMF	20,163	20,788	17,631	18,152	19,509	19,758	21,584	20,988	19,679	19,802	19,070	19,753	19,753
FEF	29,362	25,006	19,116	23,496	24,387	27,203	28,178	27,864	29,567	27,265	28,687	33,547	33,547
HAF	60,018	57,699	43,713	48,403	47,927	51,011	49,016	56,596	56,272	51,419	49,498	53,306	53,306
SAF, ISAF	56,740	57,373	55,675	55,266	55,273	57,536	60,401	58,553	59,843	59,591	57,768	57,795	57,795
Total furnace	261,233	251,463	216,741	232,067	239,516	249,621	252,750	259,930	260,499	248,944	243,983	258,589	258,589
Contact types	73,385	68,612	57,142	58,745	63,562	68,070	72,030	75,400	76,346	74,494	76,026	80,773	80,773
Totals	334,618	320,075	273,883	290,812	303,078	317,691	324,780	335,330	336,845	323,438	320,009	339,362	339,362
Exports													
Furnace types													
Total furnace	18,605	23,722	23,357	30,550	26,581	19,359	16,864	19,501	21,058	24,934	25,467	—	249,997
Contact types	18,306	21,218	15,888	19,832	17,222	13,045	13,538	12,699	14,240	12,006	12,792	—	170,786
Totals	36,911	44,940	39,245	50,382	43,803	32,404	30,402	32,200	35,298	36,940	38,259	—	420,783

Source: Bureau of Mines, United States Department of the Interior, Washington, D. C.

World Production of Natural Rubber

(1,000 Long Tons)

Year	Malaya		Indonesia		All Other	Total
	Estate	Native	Estate	Native		
1956						
Jan.	32.6	26.5	23.7	17.7	49.5	150.0
Feb.	27.6	24.3	23.0	21.0	41.6	137.5
Mar.	28.5	22.5	21.5	16.9	43.0	132.5
Apr.	26.7	21.7	20.0	46.1	40.4	155.0
May	23.5	19.8	18.0	38.4	42.9	142.5
June	29.5	23.2	21.9	25.7	47.0	147.5
July	30.8	23.9	21.3	41.3	47.6	165.0
Aug.	30.3	23.0	20.3	64.0	49.9	187.5
Sept.	30.2	21.9	21.3	28.8	42.7	145.0
Oct.	30.5	22.5	22.0	34.0	58.5	167.5
Nov.	28.4	21.3	21.9	44.0	54.1	170.0
Dec.	34.7	24.2	23.0	49.2	56.1	187.5
Total	353.0	274.4	259.0	427.8	532.9	1,887.5
1957						
Jan.	36.1	27.3	23.8	22.7	45.1	155.0
Feb.	27.1	22.1	20.6	16.4	38.8	125.0
Mar.	26.0	21.1	19.7	46.1	52.2	165.0
Apr.	26.6	22.5	19.6	41.6	39.8	150.0
May	27.2	18.3	18.1	30.4	43.5	137.5
June	29.7	21.6	20.4	29.5	43.8	145.0
July	32.5	24.1	21.0	65.9	46.5	192.5
Aug.	33.0	23.2	21.8	52.4	44.8	175.0
Sept.	31.5	21.4	21.8	37.8	35.0	157.5
Oct.	33.4	22.6	22.2	32.8	54.0	165.0
Nov.	34.4	22.7	22.2	24.5	51.2	155.0

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce; Secretariat of the International Rubber Study Group.

World Consumption of Natural Rubber

(1,000 Long Tons)

Year	United States	Eastern Europe and China	United Kingdom	Other Foreign	Total Foreign	Grand* Total
1956						
Jan.	53.7	19.1	21.7	68.8	109.6	162.5
Feb.	50.2	28.2	17.9	63.2	109.3	160.0
Mar.	50.0	23.1	16.0	71.4	110.5	160.0
Apr.	47.4	22.7	18.4	70.1	111.2	160.0
May	48.3	27.0	14.5	68.6	110.1	157.5
June	43.6	30.0	16.1	73.8	119.9	162.5
July	38.3	23.4	14.7	70.9	109.0	147.5
Aug.	46.6	13.9	10.3	64.9	89.1	135.0
Sept.	44.1	25.1	14.5	73.5	113.1	157.5
Oct.	52.1	17.5	18.8	78.3	114.6	167.5
Nov.	43.0	32.0	15.7	72.1	119.8	162.5
Dec.	45.1	34.0	14.3	66.5	114.8	160.0
Total	562.1	295.0	192.8	841.7	1,330.4	1,892.5
1957						
Jan.	52.6	13.0	14.4	74.9	102.3	155.0
Feb.	46.4	19.9	14.5	72.7	107.1	152.5
Mar.	48.3	23.6	17.6	72.7	113.9	162.5
Apr.	45.4	32.2	13.6	76.6	122.4	167.5
May	46.5	10.3	14.5	79.3	104.1	150.6
June	41.3	25.4	17.2	74.8	117.4	158.7
July	39.7	25.3	14.0	76.2	115.5	155.0
Aug.	44.9	28.0	9.7	66.8	104.5	150.0
Sept.	43.7	18.7	18.1	78.4	115.2	157.5
Oct.	48.8	...	15.3	...	...	155.0
Nov.	43.7	...	15.1	...	...	152.5

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce; and Secretariat of the International Rubber Study Group.

*Estimated.

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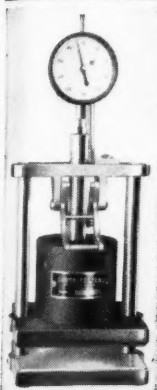
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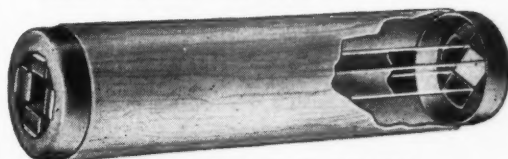
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World Consumption of Synthetic Rubber*

(1,000 Long Tons)

Year	U.S.A.	Canada	United Kingdom	Total† Continent of Europe	World† Grand Total
1956					
Jan.	78.5	4.0	3.1	9.0	100.0
Feb.	75.2	4.1	3.1	9.0	95.0
Mar.	78.3	4.1	3.1	9.0	97.5
Apr.	73.7	4.4	3.6	8.8	97.5
May	76.4	4.5	3.2	8.5	97.5
June	67.8	4.0	3.6	9.5	90.0
July	58.2	3.7	2.9	8.8	80.0
Aug.	72.5	3.3	2.3	7.5	90.0
Sept.	69.2	3.9	3.2	9.0	90.0
Oct.	82.0	4.2	4.1	10.8	105.0
Nov.	71.5	4.3	3.9	10.5	95.0
Dec.	73.3	3.8	3.6	9.8	97.5
Total	877.3	48.4	39.5	110.5	1,135.0
1957					
Jan.	85.5	4.4	3.7	11.5	110.0
Feb.	77.9	4.2	3.9	11.3	102.5
Mar.	81.7	4.3	5.4	11.5	110.0
Apr.	76.4	4.2	4.0	12.3	102.5
May	80.2	4.7	4.8	12.5	107.5
June	70.5	4.2	5.5	12.3	97.5
July	69.0	3.5	4.3	14.0	97.5
Aug.	79.3	2.8	3.0	11.2	102.5
Sept.	77.7	3.7	6.4	14.0	110.0
Oct.	88.8	4.1	5.5	14.8	120.0
Nov.	75.3	4.0	5.0	...	105.0

Source: Secretariat of the International Rubber Study Group; Bureau of the Census, Industry Division, Chemical Branch, United States Department of Commerce.

* Includes latices.

† Figures estimated or partly estimated.

World Production of Synthetic Rubber

(1,000 Long Tons)

Year	U.S.A.	Canada	Germany	Total
1956				
Jan.	93.5	9.7	1.0	104.3
Feb.	90.5	8.2	1.0	99.7
Mar.	94.4	10.3	1.1	105.8
Apr.	91.6	10.3	1.0	102.8
May	93.7	10.6	1.0	105.3
June	85.3	10.4	0.6	96.3
July	88.0	8.7	1.0	97.7
Aug.	86.5	10.2	0.9	97.6
Sept.	90.6	10.7	0.8	102.1
Oct.	88.2	10.7	0.8	99.7
Nov.	83.5	10.3	0.8	94.7
Dec.	93.8	10.6	0.8	105.2
Total	1,079.6	120.7	10.7	1,211.0
1957				
Jan.	94.3	11.1	0.9	106.2
Feb.	83.2	9.8	1.1	94.1
Mar.	93.9	11.1	1.1	106.1
Apr.	82.3	11.0	1.0	94.3
May	95.0	11.5	0.8	107.3
June	84.4	11.3	1.1	96.8
July	81.0	10.1	0.8	91.9
Aug.	93.4	11.0	1.1	105.6
Sept.	94.5	10.9	1.0	106.4
Oct.	106.4	11.4	1.1	118.9
Nov.	106.0	11.5	...	...

Source: Secretariat of the International Rubber Study Group; and Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

U.S.A. Rubber Industry Sales and Inventories

(Millions of Dollars)

	Value of Sales*				Manufacturers' Inventories*			
	1954	1955	1956	1957	1954	1955	1956	1957
Jan.	348	424	415	496	844	790	935	1,047
Feb.	351	440	445	495	857	782	970	1,036
Mar.	388	466	451	476	849	805	979	1,030
Apr.	375	445	445	490	812	784	970	1,031
May	357	465	464	481	810	810	985	1,024
June	377	465	450	458	829	850	975	1,027
July	374	471	459	514	784	853	987	1,045
Aug.	377	456	436	481	761	863	1,007	1,074
Sept.	334	456	429	481	804	874	1,007	1,074
Oct.	332	447	454	490	838	902	1,022	1,097
Nov.	388	482	463	431	819	935	1,024	1,101
Dec.	407	465	461	...	929	934	998	...
Total	4,368	5,493	5,372	...	Av. 831	845	988	...

Source: Office of Business Economics, United States Department of Commerce.

* Adjusted for seasonal variation.

U.S.A. New Supply, Consumption, Exports, and Stock of Reclaimed Rubber

(Long Tons)

Year	New Supply	Consumption	Exports	Stocks
1954	258,101	249,049	10,232	30,746
1955	326,649	312,781	13,988	31,498
1956	287,220	270,547	13,832	34,969
1957				
Jan.	25,103	24,053	1,288	34,552
Feb.	21,896	22,773	1,263	32,010
Mar.	25,088	24,633	1,298	30,975
Apr.	22,878	23,145	1,201	30,258
May	24,884	23,816	1,277	29,847
June	22,402	21,352	1,083	30,378
July	20,444	19,676	757	29,972
Aug.	20,423	22,429	917	28,521
Sept.	19,892	21,704	714	25,983
Oct.	26,419	24,925	1,230	27,171
Nov.	22,083	20,583	1,150	27,855
Dec.	20,101	18,263	843	29,323
Total*	271,647	267,352	13,021	29,323
1958				
Jan.*	21,159	21,186	...	29,569

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

* Preliminary.

U.S.A. Synthetic Rubber Industry, Wages, Hours

Year	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings
1956			
Oct.	107.52	42.0	2.56
Nov.	103.57	41.1	2.52
Dec.	107.33	41.6	2.58
1957			
Jan.	106.30	41.2	2.58
Feb.	104.19	40.7	2.56
Mar.	104.86	40.8	2.57
Apr.	103.94	40.6	2.56
May	105.93	40.9	2.59
June	103.88	39.8	2.61
July	108.75	41.2	2.64
Aug.	109.34	40.8	2.68
Sept.	108.40	40.6	2.67
Oct.	108.14	40.5	2.67
Nov.	113.71	41.5	2.74

Source: BLS, United States Department of Labor.

U.S.A. Rubber Use by Products

(1,000 Long Tons)

Year	Transportation			Non-Transportation			Grand Total
	Natural	Synthetic	Total	Natural	Synthetic	Total	
1952	303.2	539.4	842.6	150.6	267.7	418.3	1,260.9
1953	358.2	500.3	858.5	195.3	284.7	479.8	1,338.3
1954	386.3	391.0	777.3	210.0	245.8	455.7	1,233.0
1955	409.6	550.3	959.9	225.2	344.7	569.8	1,529.7
1956	364.0	533.0	897.0	198.1	341.3	539.5	1,436.5
1957							
1st q.	94.8	152.9	247.7	52.5	91.5	144.0	391.7
2nd q.	85.4	142.7	228.1	47.8	84.3	132.1	360.2
3rd q.	81.7	143.6	225.3	46.7	82.2	129.1	354.4

Source: Secretariat of the International Rubber Study Group.

MACHINERY & SUPPLIES FOR SALE (Cont'd)

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	Shipments				Production	Inventory End of Period
	Original Equipment	Re- place- ment	Export	Total		
Passenger Car						
1956	30,874	42,411	876	85,000	95,546	16,494
1957						
Jan. . .	3,192	4,521	100	7,812	8,296	16,978
Feb. . .	3,017	4,453	68	7,538	8,047	17,376
Mar. . .	3,051	4,875	80	8,006	8,629	18,065
Apr. . .	2,809	5,218	78	8,104	7,878	17,821
May . . .	2,831	5,166	60	8,057	8,313	18,050
June . . .	2,623	5,532	63	8,217	7,462	17,322
July . . .	2,719	5,826	65	8,611	7,449	16,097
Aug. . .	2,886	5,675	66	8,627	7,801	15,348
Sept. . .	1,398	5,096	70	6,564	7,535	16,310
Oct. . .	2,298	4,392	88	6,778	8,437	17,998
Nov. . .	3,179	3,250	62	6,491	6,575	15,596
Dec. . .	2,803	2,858	78	5,739	6,597	19,818
Total	32,724	56,605	888	90,217	93,547	19,818
1958						
Jan. . .	2,376	4,838	50	7,264	6,740	19,298
Truck and Bus						
1956	4,548	8,894	883	14,326	14,589	3,378
1957						
Jan. . .	305	678	83	1,066	1,208	3,512
Feb. . .	344	598	59	1,001	1,122	3,633
Mar. . .	330	704	74	1,107	1,136	3,678
Apr. . .	438	771	49	1,277	1,072	3,486
May . . .	399	620	74	1,094	1,178	3,580
June . . .	370	715	64	1,149	1,027	3,461
July . . .	349	819	61	1,229	994	3,219
Aug. . .	328	813	65	1,206	1,117	3,129
Sept. . .	290	805	63	1,158	1,105	3,083
Oct. . .	322	959	94	1,375	1,271	2,987
Nov. . .	337	626	59	1,021	1,060	3,207
Dec. . .	266	484	70	820	1,018	3,408
Total	4,041	8,544	845	13,430	13,394	3,408
1958						
Jan. . .	277	674	57	1,007	1,074	3,470
Total Automotive						
1956	35,423	62,147	1,759	99,327	100,407	19,872
1957						
Jan. . .	3,496	5,199	183	8,878	9,504	20,490
Feb. . .	3,361	5,052	127	8,539	9,169	21,009
Mar. . .	3,381	5,579	154	9,114	9,766	21,743
Apr. . .	3,246	5,989	146	9,381	8,950	21,308
May . . .	3,230	5,787	134	9,150	9,490	21,630
June . . .	2,993	6,247	127	9,366	8,489	20,783
July . . .	3,068	6,646	126	9,840	8,443	19,316
Aug. . .	3,214	6,488	130	9,833	8,917	18,477
Sept. . .	1,688	5,902	133	7,723	8,641	19,393
Oct. . .	2,620	5,351	182	8,154	9,708	20,985
Nov. . .	3,516	3,876	121	7,513	7,636	18,803
Dec. . .	3,070	3,341	148	6,559	7,615	23,225
Total	36,764	65,150	1,734	103,647	106,941	23,225
1958						
Jan. . .	3,653	5,511	107	8,271	7,814	22,769

Source: The Rubber Manufacturers Association, Inc.

U.S.A. Rubber Industry Employment, Wages, Hours

	Production Workers (1000's)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Consum- er's Price Index
		All Rubber	Products		
1939	121	\$27.84	39.9	\$0.75	
1955	214.7	87.15	41.7	2.09	114.5
1956					
Sept.	209.9	89.10	40.5	2.20	117.1
Oct.	214.5	89.98	40.9	2.20	117.7
Nov.	194.4	87.89	40.5	2.17	117.8
Dec.	215.8	92.74	41.4	2.24	118.0
1957					
Jan.	216.0	91.21	40.9	2.23	118.2
Feb.	212.6	90.80	40.9	2.22	118.7
Mar.	211.4	89.28	40.4	2.21	118.9
Apr.	191.3	87.60	40.0	2.19	119.3
May	204.6	88.80	40.0	2.22	119.6
June	196.8	91.21	40.9	2.23	120.2
July	199.9	94.16	41.3	2.28	120.8
Aug.	204.3	92.84	40.9	2.27	121.0
Sept.	206.4	93.02	40.8	2.29	121.1
Oct.	209.5	93.03	40.1	2.32	121.1
Nov.	208.6	92.97	39.9	2.33	121.6
Dec.	204.4				121.6
		Tires and Tubes			
1939	54.2	\$33.36	35.0	\$0.96	
1955	88.6	101.09	41.6	2.43	
1956					
Sept.	86.0	102.51	40.2	2.55	
Oct.	86.0	102.66	40.1	2.56	
Nov.	70.1	103.53	40.6	2.55	
Dec.	87.3	109.25	41.7	2.62	
1957					
Jan.	87.4	107.64	41.4	2.60	
Feb.	86.8	106.19	41.0	2.59	
Mar.	86.9	102.40	40.0	2.56	
Apr.	71.1	103.46	40.1	2.58	
May	84.9	103.46	40.1	2.58	
June	78.2	107.23	41.4	2.59	
July	84.4	112.20	42.5	2.64	
Aug.	84.2	107.83	41.0	2.63	
Sept.	84.4	107.20	40.3	2.66	
Oct.	84.4	105.18	39.1	2.69	
Nov.	83.8	106.35	39.1	2.72	
		Rubber Footwear			
1939	14.8	\$22.80	37.5	\$0.61	
1955	18.2	70.70	40.4	1.75	
1956					
Sept.	19.4	71.71	39.4	1.82	
Oct.	19.3	71.71	39.4	1.82	
Nov.	18.9	71.55	39.1	1.83	
Dec.	18.6	73.26	39.6	1.85	
1957					
Jan.	18.3	71.76	39.0	1.84	
Feb.	17.8	72.10	39.4	1.83	
Mar.	17.8	72.86	39.5	1.84	
Apr.	17.5	70.64	38.6	1.83	
May	17.3	71.92	39.3	1.83	
June	17.4	72.29	39.5	1.83	
July	16.9	72.13	39.2	1.84	
Aug.	17.2	73.05	39.7	1.84	
Sept.	17.6	74.45	39.6	1.88	
Oct.	17.7	76.02	39.8	1.91	
Nov.	18.0	79.35	40.9	1.94	
		Other Rubber Products			
1939	51.9	\$23.34	38.9	\$0.61	
1955	107.9	78.35	41.9	1.87	
1956					
Sept.	104.5	81.18	41.0	1.98	
Oct.	109.2	82.98	41.7	1.99	
Nov.	105.4	79.98	40.6	1.97	
Dec.	109.9	82.59	41.5	1.99	
1957					
Jan.	110.3	81.39	40.9	1.99	
Feb.	108.0	81.18	41.0	1.98	
Mar.	106.7	81.19	40.8	1.99	
Apr.	102.7	79.60	40.2	1.98	
May	102.2	79.80	40.1	1.99	
June	101.2	81.81	40.7	2.01	
July	98.6	82.62	40.7	2.03	
Aug.	102.9	83.84	41.1	2.04	
Sept.	104.4	85.08	41.1	2.07	
Oct.	107.4	86.10	41.0	2.10	
Nov.	106.8	84.84	40.4	2.10	

Source: BLS, United States Department of Labor.

U.S.A. Production of Cotton, Rayon, and Nylon Tire Fabrics

	Cotton and Nylon*		Rayon Tire Cord		Total All Tire Cord and Fabrics
	Cotton Chafer Fabrics and Other Tire Fabrics	Cotton and Nylon Tire Cord and Fabrics	Woven	Not Woven	
1956	40,660	6,157	248,629	84,033	449,479
1957					
Jan.-Mar.	11,028	20,676	69,610	21,872	124,297
Apr.-June	10,456	24,852	63,195	16,037	115,418
July-Sept.	9,102	24,852	54,968	10,509	100,046
Oct.-Dec.	10,176	23,903	58,392	9,216	101,687

* Cotton and nylon figures combined to avoid disclosing data for individual companies.

Source: Bureau of the Census, United States Department of Commerce.

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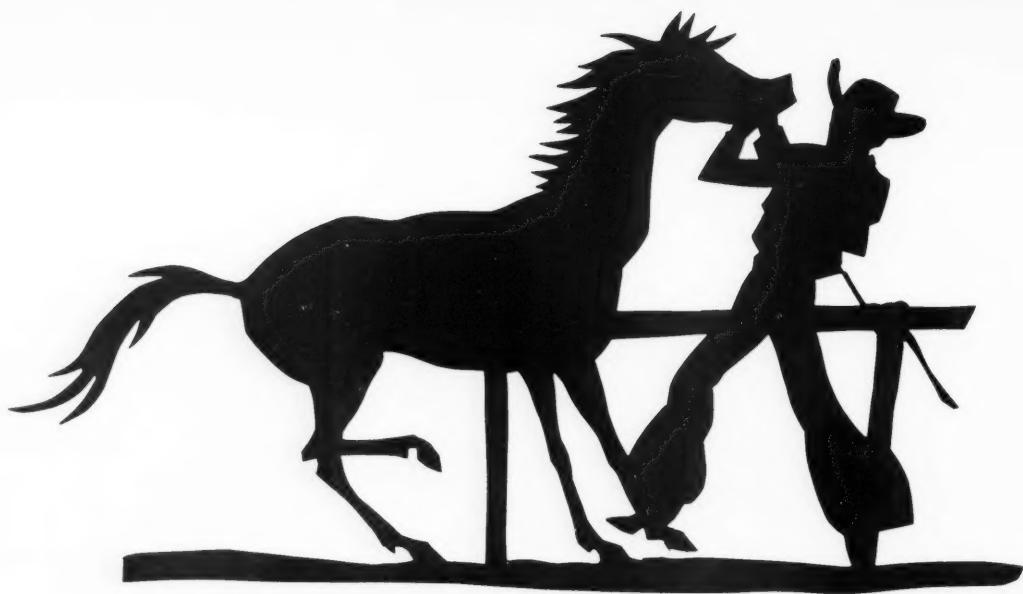
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